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**ACTIVE MICROWAVE INVESTIGATION
OF SNOWPACKS: EXPERIMENTAL
DATA DOCUMENTATION, COLORADO
1979-1980**

Contract No. NSG 5335

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ACTIVE MICROWAVE INVESTIGATION OF SNOWPACKS: EXPERIMENTAL DATA DOCUMENTATION, COLORADO 1979-1980

Remote Sensing Laboratory
RSL Technical Report 410-3

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July 1981

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TABLE OF CONTENTS

	<u>Page</u>
LIST OF FIGURES	iii
LIST OF TABLES.	v
ABSTRACT.	vi
ACKNOWLEDGMENTS	vii
1.0 INTRODUCTION	1
2.0 EXPERIMENT TEST SITES.	3
2.1 Site 1: Steamboat Springs, Colorado.	3
2.2 Site 2: Steamboat Springs, Colorado.	9
2.3 Site 3: Steamboat Springs, Colorado.	9
2.4 Site 4: Winter Park, Colorado.	13
3.0 TARGET DATA.	13
3.1 Test-Site Homogeneity	13
3.2 Meteorological Data	18
3.3 Snow Data	18
3.3.1 Snow Depth, Stratification, Density Profile and Water Equivalent	18
3.3.2 Temperature Profiles	23
3.3.3 Snow Grain Size.	27
3.3.4 Snow Liquid Water.	27
3.3.5 Snow Surface Roughness	31
3.4 Soil Data	33
4.0 RADAR DATA	33
4.1 System Descriptions	33
4.2 Data Acquisition Procedure.	36
5.0 SUMMARY.	39
REFERENCES.	40

LIST OF APPENDICES

Appendix A1	Meteorological Data	1.0
Appendix A2	Snow Stratification, Density and Water Equivalent	2.0
Appendix A3	Snow Temperature Profiles	3.0
Appendix A4	Snow Liquid Water	4.0
Appendix A5	Snow Surface Roughness.	5.1
Appendix A6	Soil Data	6.0
Appendix A7	Unprocessed Stratification Data and Field Notes . .	7.0
Appendix B	Radar Data.	8.0

LIST OF FIGURES

	<u>Page</u>
Figure 2.1. Location of test sites for the snowpack measurements.	4
Figure 2.2. Location of the test sites near Steamboat Springs, Colorado	6
Figure 2.3. Test Site #1 layout showing snow pit and truck locations, and homogeneity test data.	7
Figure 2.4. Test Site #1 looking northwest from the instrumentation van on January 9, 1980.	8
Figure 2.5. Test Site #2 layout illustrating snow pit and truck locations and homogeneity test data . .	10
Figure 2.6. Photograph of Test Site #3 looking southwest from the instrumentation van.	11
Figure 2.7. Test Site #3 layout illustrating snow pit and truck locations and homogeneity test data . .	12
Figure 2.8. Location of Test Site #4 near Winter Park, Colorado.	14
Figure 2.9. Test Site #4 layout illustrating snow pit and truck locations along with homogeneity test data.	15
Figure 2.10. Photographs of (a) the snow-covered field on 12/20/79 after settling and of (b) the bare-ground area	16
Figure 3.1. Stratification data for Test Site #1 (a) and (b) and (c) for Test Sites #2, #3, and #4. Shaded layers are crust or ice. The numbers designate layer codes and new snowfalls show up as vertical increases in depth	20
Figure 3.2. Water equivalent data for all test sites during (a) December 1979, (b) January 1980 and (c) February 1980. New snowfall measured in water equivalent is illustrated by the magnitude of the arrows	24

Figure 3.3.	Maximum observed snow grain size for the snowpack, with the majority of the grain sizes being between this value and one-half of the value. Fresh snow grains were on the order of 0.2 mm in size.	28
Figure 3.4.	Photograph of the snow surface roughness on 12/15/79 at Test Site #4 using a 2 cm x 2 cm grid	32
Figure 3.5.	Soil moisture contents in percent by dry weight	34
Figure 4.1.	Photographs of the MAS systems illustrating (a) the RF-sections mounted on the hydraulic boom with the NASA C-130 in the background and (b) the boom truck and instrumentation van at Test Site #4. . . .	38

LIST OF TABLES

		<u>Page</u>
Table 1.1	Data Base Summary	2
Table 2.1	Snow Parameter Variation for the Four Test Sites	5
Table 3.1	Mean Snowpack Depth and Standard Deviation Based on N Samples from the Perimeters of the Test Plots	17
Table 4.1	MAS 1-8 and MAS 8-18/35 System Specifications	37

ACTIVE MICROWAVE INVESTIGATION OF SNOWPACKS:
EXPERIMENTAL DATA DOCUMENTATION, COLORADO 1979-1980

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ABSTRACT

During the winter of 1979-1980, the University of Kansas Microwave Active Spectrometer Systems measured the backscattering properties of snowpacks under varying conditions at four test sites in Colorado. In addition to the radar data over 1-35 GHz, ground-truth measurements of the atmospheric, snow and soil characteristics were obtained for each radar data set.

This report describes the test sites, data acquisition procedures and presents the data that were acquired in this experiment.

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1.0 INTRODUCTION

A measurement program was conducted at four test sites in Colorado in 1979-1980 to investigate the active microwave response to snowpack parameters. The objective of this program was to develop algorithms for remotely monitoring the water equivalent and liquid water content of naturally occurring snowpack. Previous experiments performed by the Remote Sensing Laboratory at the University of Kansas had provided a qualitative and, to a limited extent, quantitative understanding of the interaction processes between the microwave energy and the snow [1-4]. However, weather and climatic conditions in all of the above experimental situations limited the range over which snow depth varied. In addition, it was desired to observe site-to-site variations.

A short summary of the experiment objectives follows:

- a) To acquire data at multiple test sites in the Colorado mountains. The test sites were selected to provide a variety of snow accumulation conditions.
- b) To obtain microwave measurements between 1.0 and 35.6 GHz over 0° to 70° angles of incidence for linear polarizations.
- c) To obtain extensive ground-truth measurements on the meteorological, snow, and soil conditions such that quantitative understanding of the microwave/ground-truth interaction mechanisms would be possible.

This report documents the test-site selection, data acquisition procedures for both radar and ground truth, and presents the data acquired during the experiment. Table 1.1 summarizes the volume of data that were acquired.

TABLE 1.1
Data Base Summary

Time Span: 12/15/79 to 02/25/80

Radar Data Days: 36

Ground-Truth Data Days: 36

<u>System</u>	<u>Data Sets</u>
MAS 1-8	139
MAS 8-18	133
Liquid Water Content	86
Density Profiles	45
Temperature Profiles	127
Soil Moisture Profiles	31

2.0 EXPERIMENT TEST SITES

Four test sites were chosen in the Colorado Rocky Mountains. It was hoped that these choices would typify the differences in snow conditions over mountainous areas including variations between sites within a single valley, among different valleys, and between valleys and mountain passes. The following requirements had to be met in order for a site to be selected:

- a) Flat, fairly homogeneous, unobstructed target area.
- b) Accessible from periodically cleared roadways.
- c) Within a reasonable radius from the base of operations.

Figure 2.1 shows the locations of the test sites on a map of Colorado. Table 2.1 summarizes the range of variation in ground-truth conditions observed at each test site, while succeeding paragraphs describe each of the test sites in more detail, giving locations, elevation, snow-depth uniformity, and photographs of the areas.

2.1 Site 1: Steamboat Springs, Colorado

Site 1 was a 40-acre hayfield located approximately seven miles south of Steamboat Springs, at an elevation of 6,500 feet. The exact location is given in Figure 2.2. This field, which had been observed in a previous experiment [2,3], is very flat with a short-cut hay cover and is located along a NASA flight line. Figure 2.3 illustrates the observation area and indicates the snow-pit position. The trucks, which housed and supported the radar systems, were parked along the side of the road and the interior of the field was sampled.

Figure 2.4 is a photograph of the field on January 9, 1980, showing the visual homogeneity. In addition, the snow-depth uniformity was

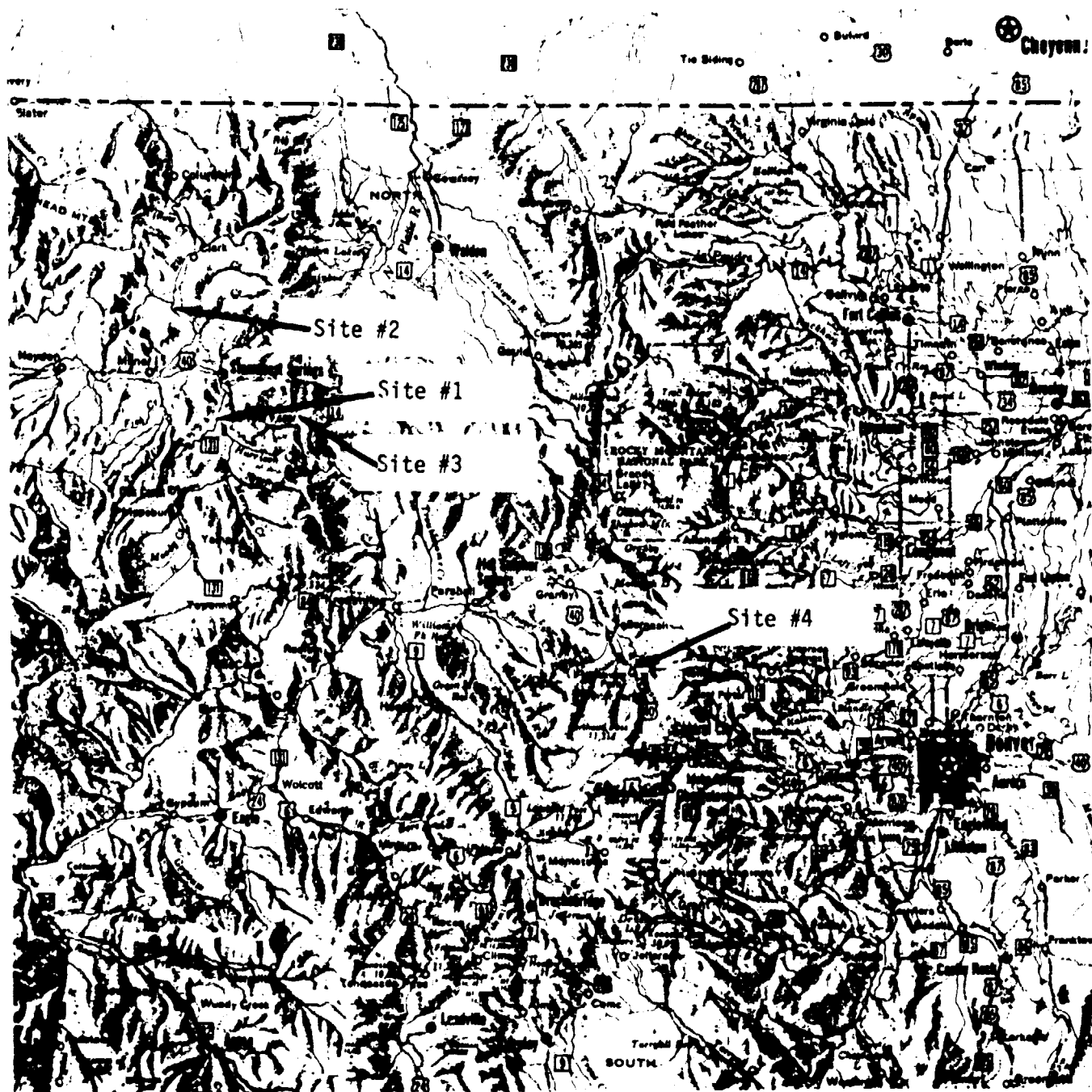


Figure 2.1. Location of test sites for the snowpack measurements.

Table 2.1
Snow Parameter Variation for the Four Test Sites

Site	Snow Depth		Water Equi- valent		Number of Layers		Surface Li- quid Water		Soil State	
	(cm)		(cm)				m _v (%)		Fro- Tha-	
	Max	Min	Max	Min	Max	Min	Max	Min	zen	wed
1	89.5	52*	21.3	7.2	11	3	7.4	0		Y
2	96.0	71	24.4	16.6	10	9	0.0	0	Y	Y
3	111.0	104	33.4	26.2	7	6	0.2	0		Y
4	49.0	38.5*	9.4	8.1	5	4	1.6	0	Y	Y

*-Bare ground was also observed
Y-Yes

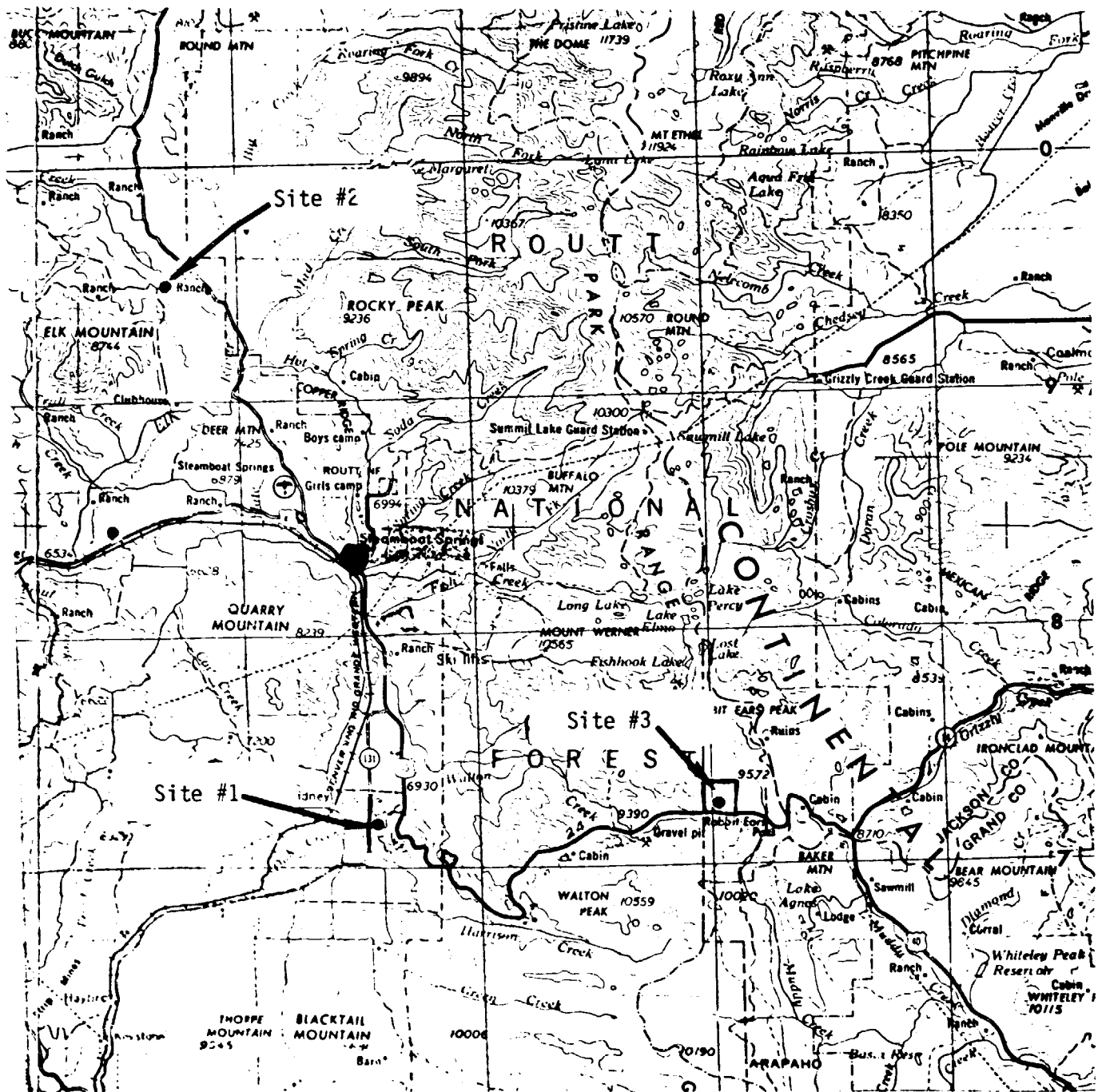


Figure 2.2. Location of the test sites near Steamboat Springs, Colorado.

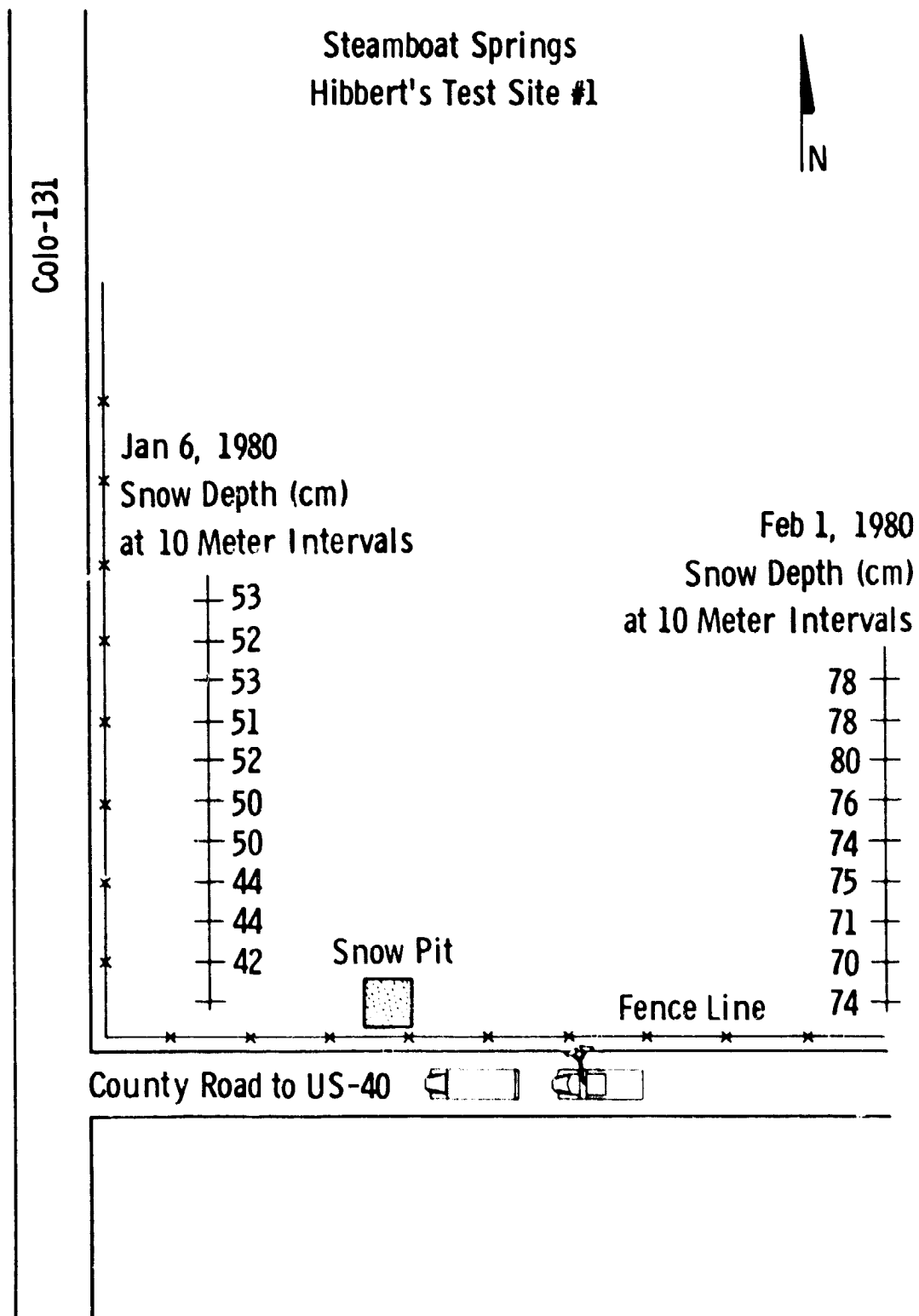


Figure 2.3 Test Site #1 layout showing snow pit and truck locations, and homogeneity test data.

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Figure 2.4. Photograph of Test Site #1 looking northwest from the instrumentation van on January 9, 1980.

checked, is shown in Figure 2.3 and is discussed in Section 3.1.

This field was leased from Ben T. Hibbert of Steamboat Springs.

2.2 Site 2: Steamboat Springs, Colorado

Site 2 was also a close-cut hay field located approximately 10 miles north of Steamboat Springs, at an elevation of 7,400 feet; its location is shown in Figure 2.2. Snowfall over this field was slightly heavier than that at Site 1 due to the increase in elevation and local snow showers, while other snow and soil characteristics of the fields at Sites 1 and 2 were similar. Figure 2.5 shows the radar system and snow-pit location. Discussion of the snow-depth uniformity is given in Section 3.1.

This field was the property of the Bar Lazy-L Ranch of Steamboat Springs.

2.3 Site 3: Steamboat Springs, Colorado

Site 3 was located between the east and west summits of Rabbit Ears Pass adjacent to US-40 on the northwest corner of the intersection with the Dumont Lake road. As a result of snow cover during the site survey in November, the surface topography was not known exactly, however, it appeared to be a relatively flat mountain meadow as shown from the photograph in Figure 2.6. The snow-depth variability discussed in Section 3.1 shows the above assumption to be valid. Figure 2.7 illustrates the test-site layout. The site is at an elevation of about 9,500 feet and is in the Routt National Forest.

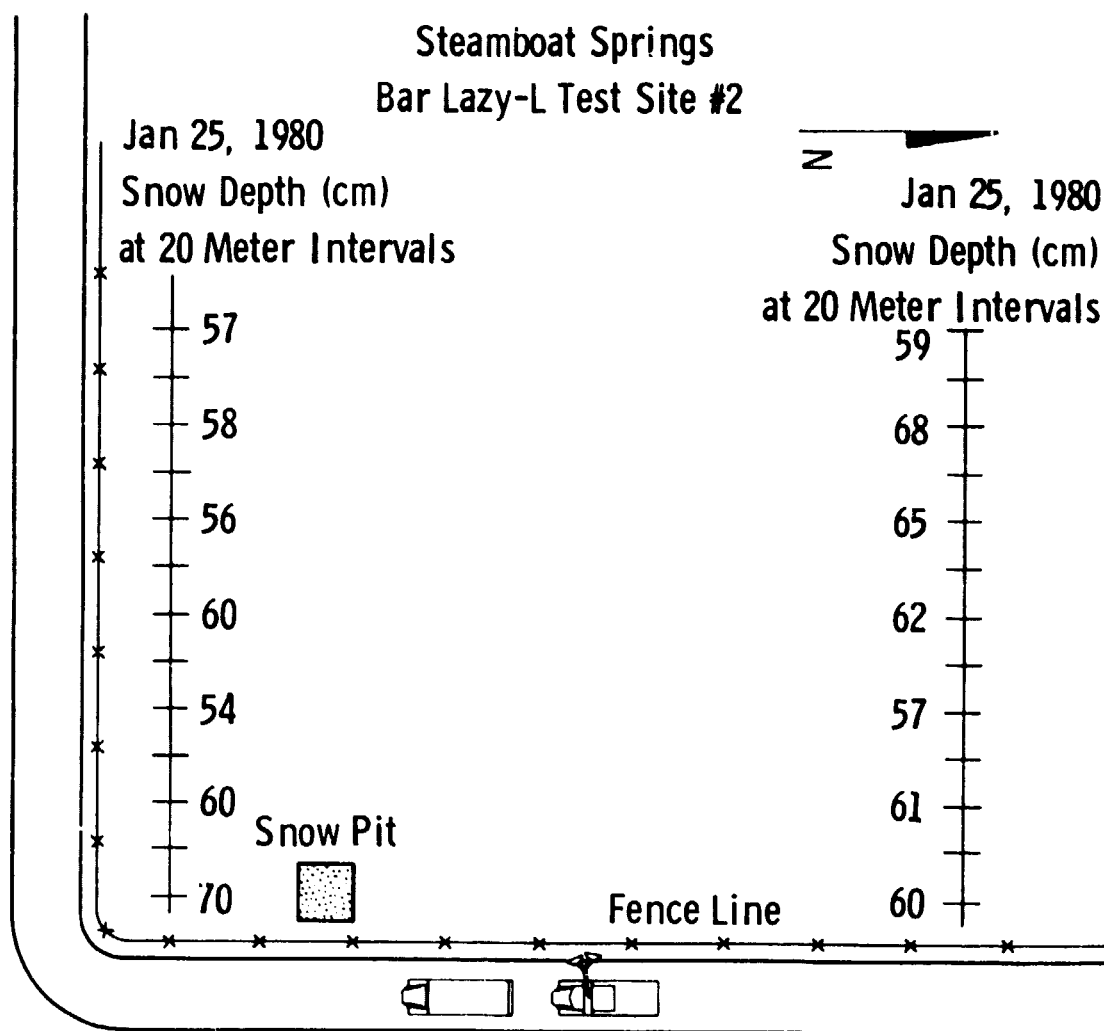


Figure 2.5. Test Site #2 layout illustrating snowpit and truck locations and homogeneity test data.

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Figure 2.6. Photograph of Test Site #3 looking south-west from the Instrumentation Van.

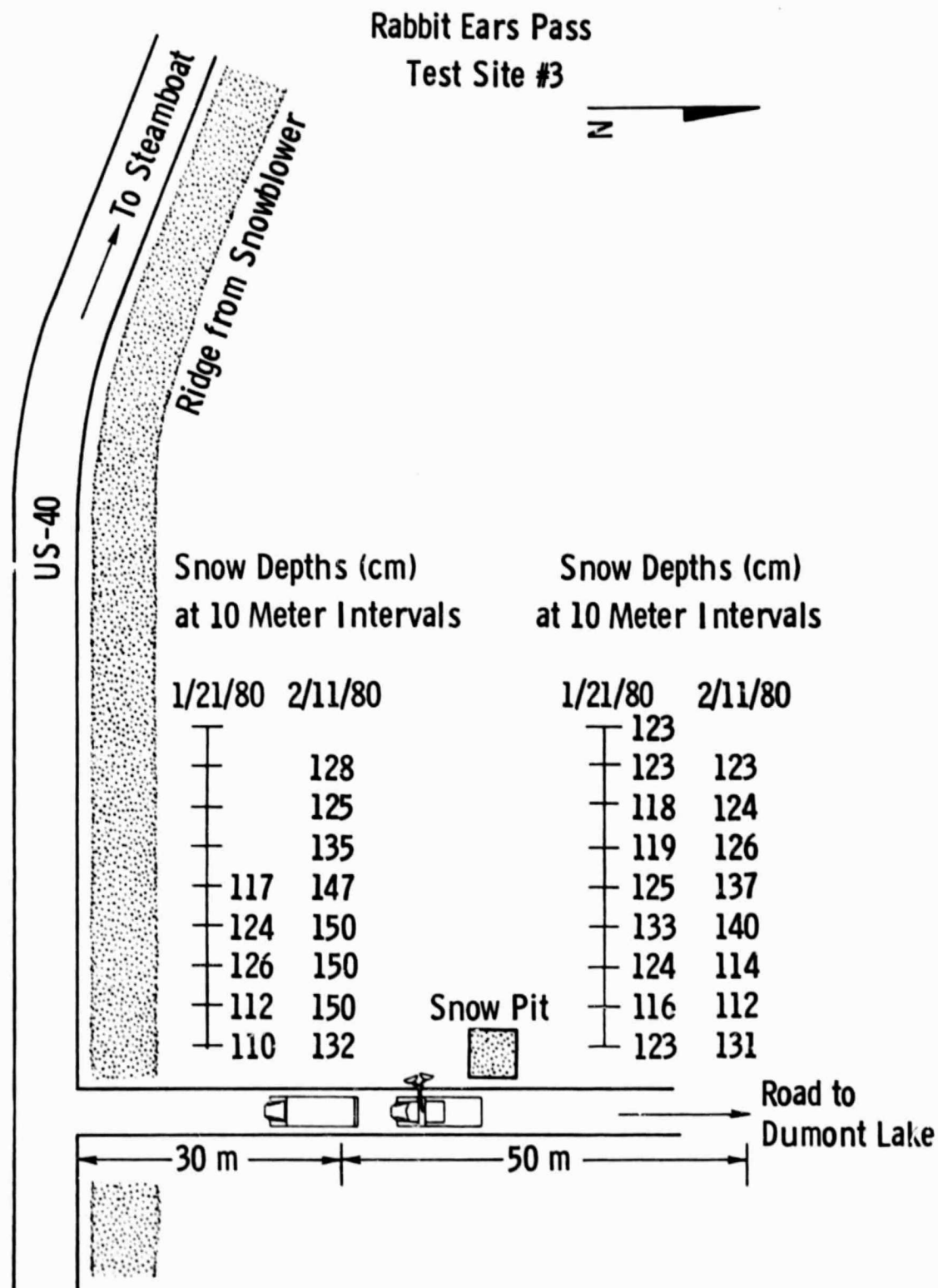


Figure 2.7. Test Site #3 layout illustrating snow pit and truck locations and homogeneity test data.

2.4 Site 4: Winter Park, Colorado

Site 4 was located in the valley between Winter Park and Fraser, Colorado as shown in Figure 2.8. Figure 2.9 illustrates the layout of the test site for both snow-cover and bare-ground measurements. Also given are the snow-depth homogeneity measurements which will be discussed in Section 3.1. Figure 2.10 shows the snow-covered area and the "bare-ground" area which was grass-covered pasture at an elevation of 9,000 feet.

This test site is the property of Regis College of Denver, Colorado.

3.0 TARGET DATA

This section gives procedures, techniques and summarizes results of the ground-truth data acquisition effort. A summary of the ranges of variation in parameters was given in Table 2.1.

3.1 Test-Site Homogeneity

The radar system inherently needs to average over an area much larger than its footprint to obtain a precise estimate of the backscatter coefficient. Since it was impractical to obtain ground-truth data at very many points in or around the observation area and since transects could not be made without disturbing the snow, snow-depth measurements were obtained along the perimeters at the regular intervals shown in Figures 2.3, 2.5, 2.7 and 2.8. Water equivalent distributions could also have been obtained, however, in a previous experiment [3] it was found that the standard deviation σ_h normalized to the mean \bar{h} was similar, for both depth and water equivalent for a given field. Table 3.1 gives the means and standard deviations for

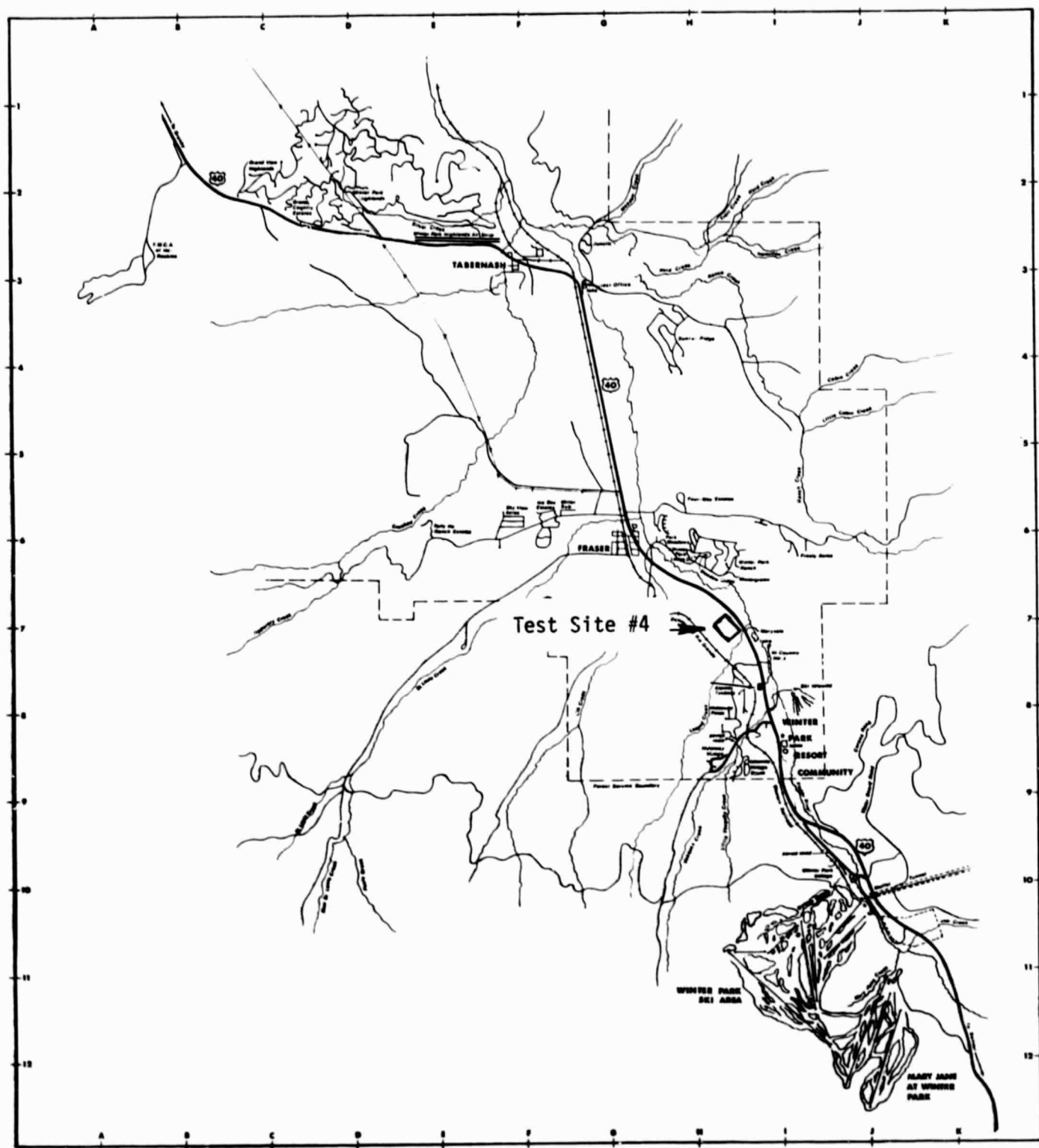


Figure 2.8. Location of Test Site #4 near Winter Park, Colorado.

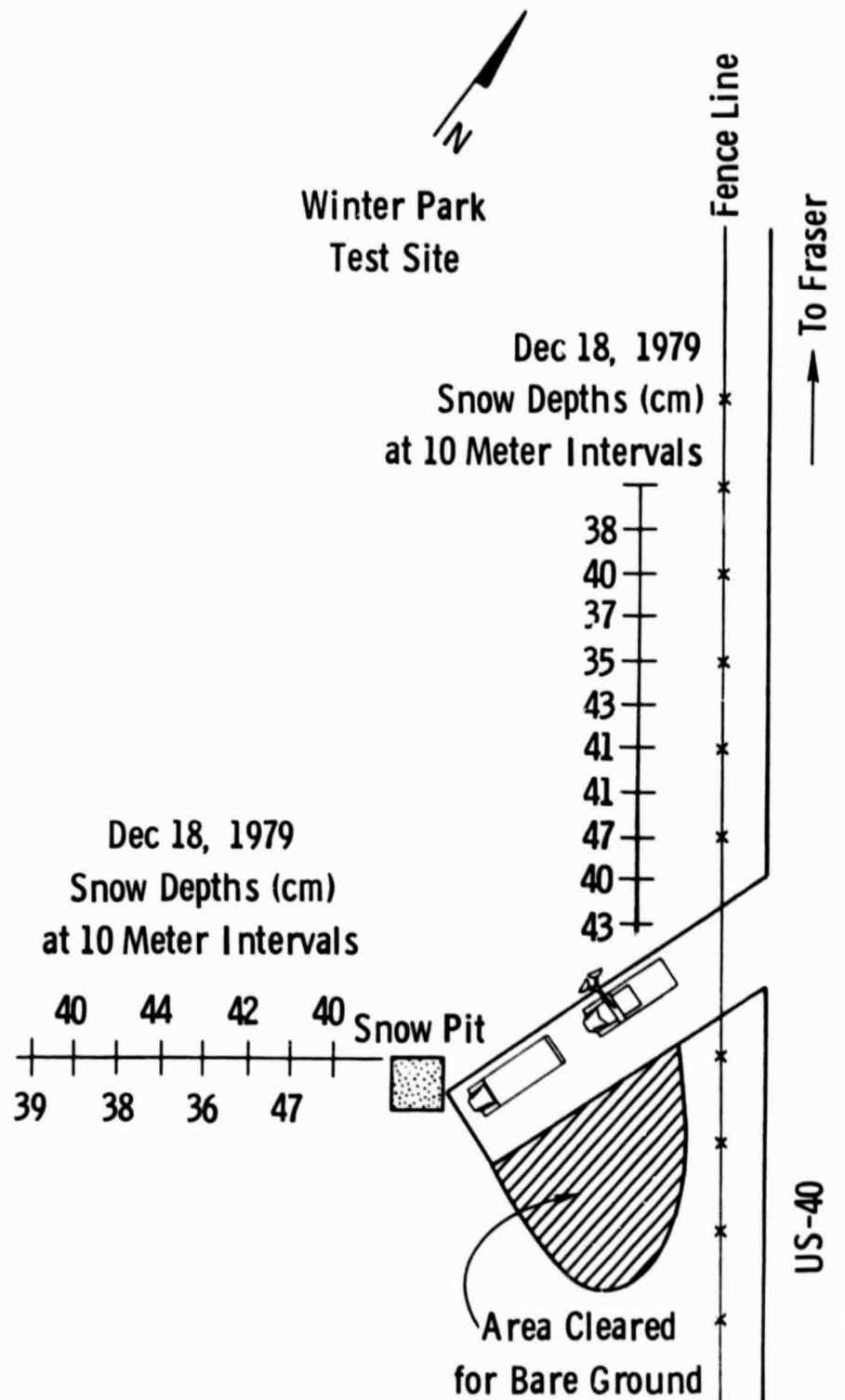
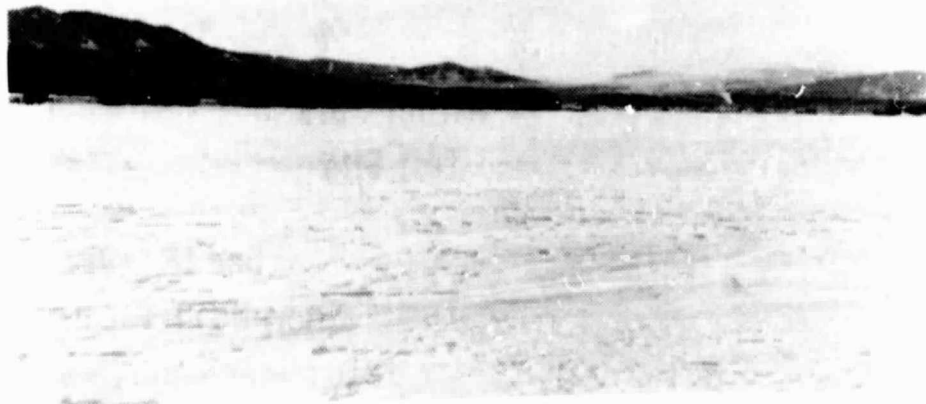


Figure 2.9. Test Site #4 layout illustrating snow pit and truck locations along with homogeneity test data.



(a)



(b)

Figure 2.10. Photographs of (a) the snow-covered field on 12/20/79 after settling and of (b) the bare-ground area.

TABLE 3.1

Mean Snowpack Depth and
Standard Deviation Based on N
Samples from the Perimeters of the Test Plots

Site	Date	N	Mean Depth \bar{h} (cm)	Standard Deviation σ_h (cm)
1	01/06/80	10	49.6	3.7
1	02/01/80	9	75.1	3.6
2	01/25/80	14	60.5	4.5
3	01/21/80	14	120.9	6.6
3	02/11/80	16	132.8	11.7
4	12/18/79	18	40.6	3.5

each of the test sites. The maximum σ_h/\bar{h} ratio is 8.8% indicating that each site was fairly uniform. Once uniformity had been verified, the depth, density, and stratification data were obtained from a single spot, the snow pits, and were assumed to be representative of the entire field.

3.2 Meteorological Data

Temperature was recorded continuously by a spring-driven Weather Measure Meteorograph operating on a seven-day cycle. Although the reproduction quality is poor, these charts, which are an indication of the thermal history of the pack, are included as Appendix A1.

3.3 Snow Data

The snow-truth data were comprised of the following information: depth, stratification, density profile, water equivalent, temperature profile, liquid-water measurements, grain-size estimates and surface roughness photographs.

3.3.1 Snow Depth, Stratification, Density Profile and Water Equivalent

Snow depths were monitored both in examining site uniformity and in conjunction with the density profiles. Snow pits were dug and expanded to undisturbed snow for each observation of stratification and sampling of the density profile.

For stratification, a vertical cut was made in the snow and the thickness and position of each distinct layer was noted. Several techniques were used to determine the layer boundaries when there were subtle changes, however, resistance to the movement of a spatula was the

standard method. Once the layering had been determined, the density of each layer was sampled with one of two procedures depending upon layer density and thickness. When possible, three horizontal cores of 3.8 cm diameter and 105 ml volume were obtained from each layer with a PVC tube. These cores were then weighed and the density calculated. For a layer of too low a density or thinner than 3.8 cm, a rectangular solid was removed weighed, and its dimensions recorded.

Water equivalent (W) is defined as the depth of a column of water which would result from complete melt of the snow and is found from:

$$\rho_w W = \rho_s d \quad (3-1)$$

where ρ_w is the density of water (approximately 1.0 g/cm^3), ρ_s is the snow density and d is the snow depth. Therefore

$$W = \rho_s d \quad (\text{cm}) \quad (3-2)$$

Water equivalent was calculated based on the measurements of density and depth of each layer while, additionally, a 7.6 cm diameter vertical core of the entire snow pack was obtained to give a direct measurement. The calculations based on density of each layer, always overestimated the water equivalent and therefore only the overall measurement should be used. Layer 20 is the code for W.

Figure 3.1 illustrates the stratification variation for the four test sites at the times of the radar measurements. The layers were assigned numbers starting from the ground upwards. Layer formation resulted from two processes, the first of which was snowfall accumulation. Generally, new snowfalls resulted in distinct new

Stratification Data Site # 1, Hibbert 1980

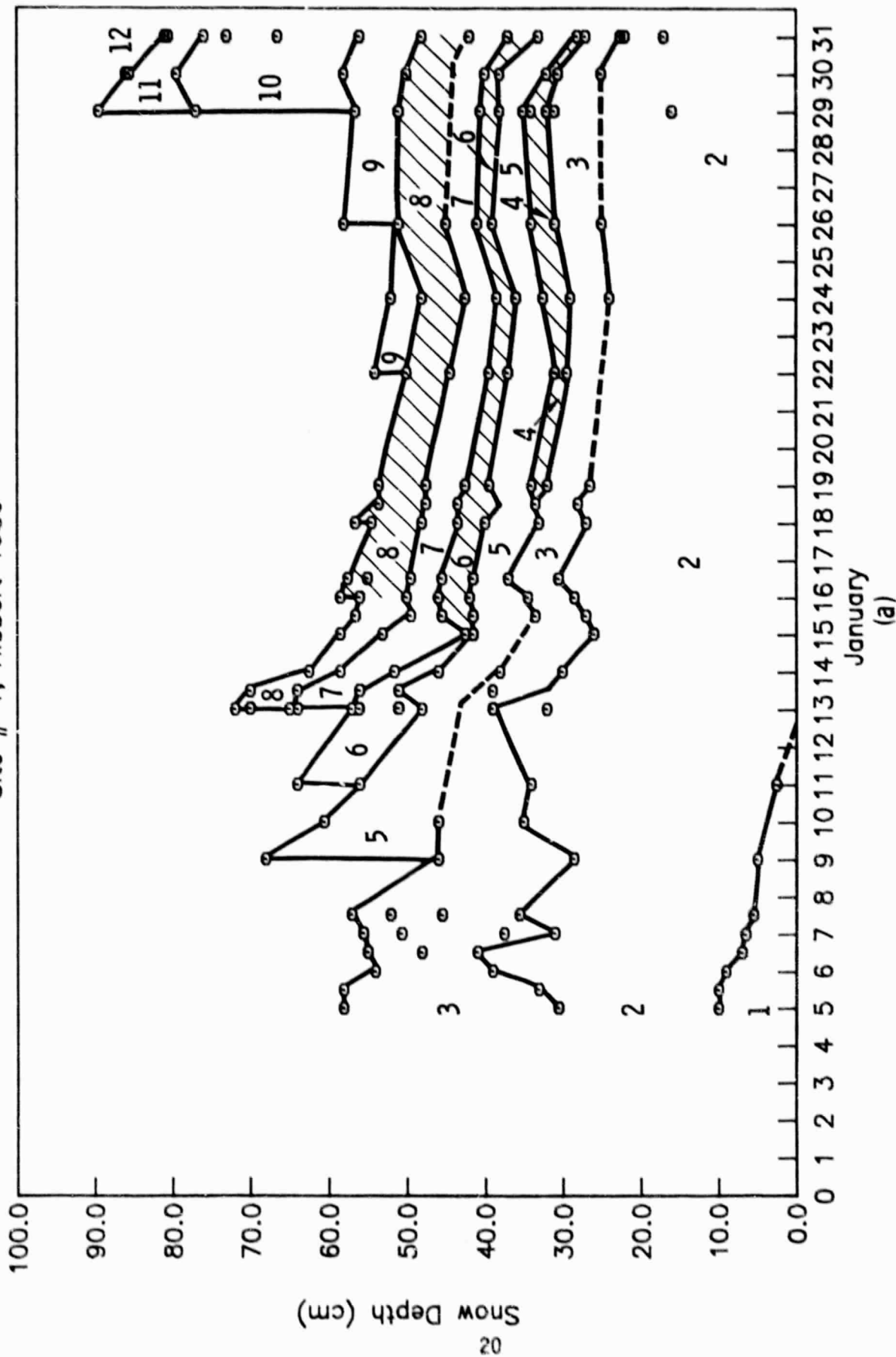
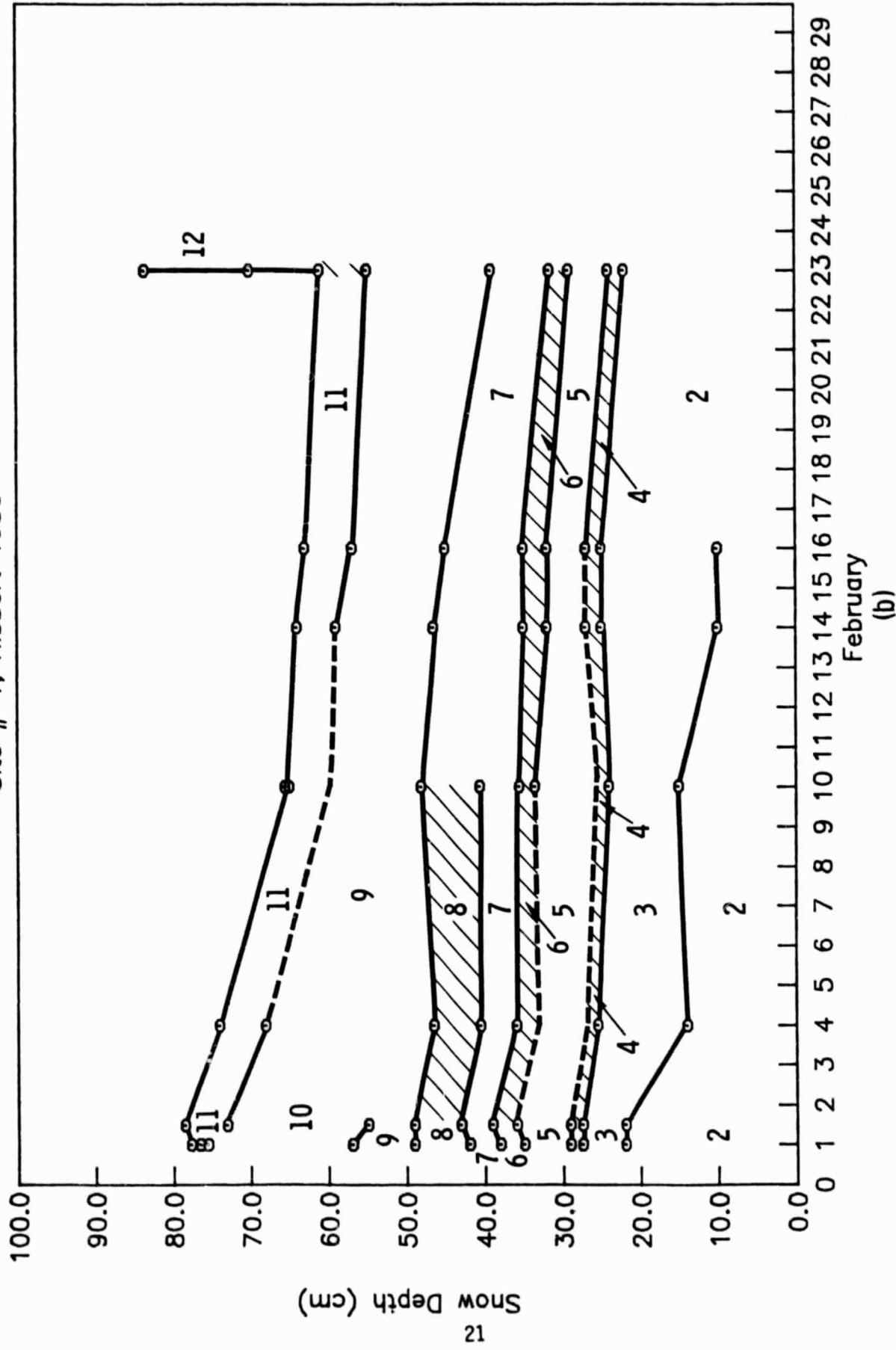
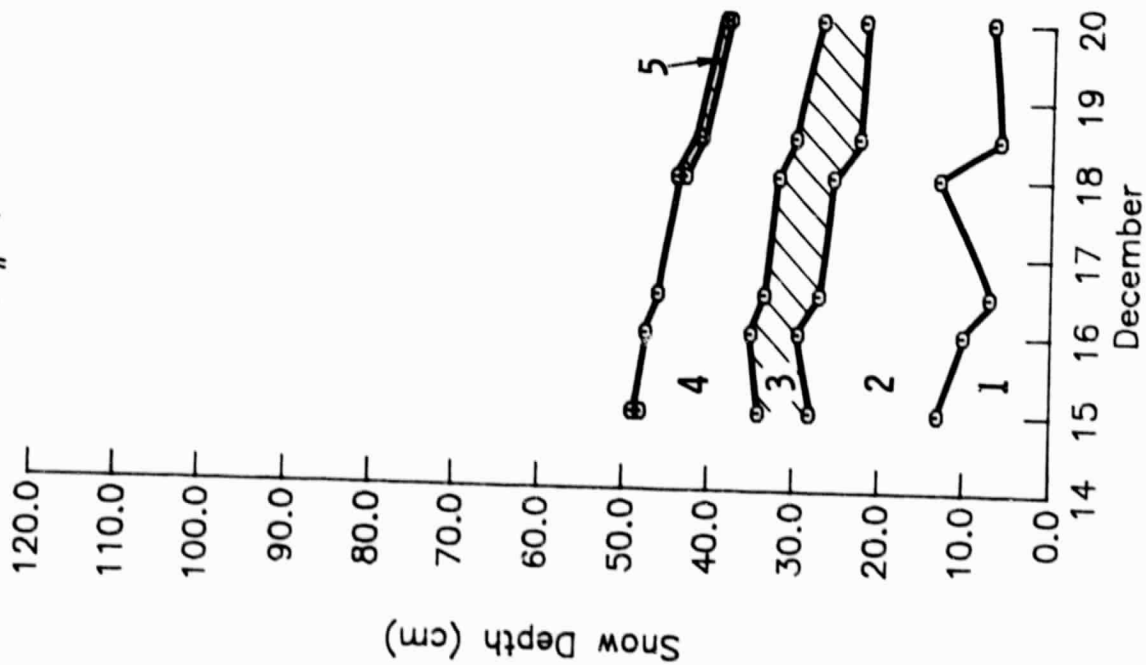


Figure 3.1. Stratification data for Test Site #1 (a) and (b) and (c) for Test Sites #2, #3, and #4. Shaded layers are crust or ice. The numbers designate layer codes and new snowfalls show up as vertical increases in depth.

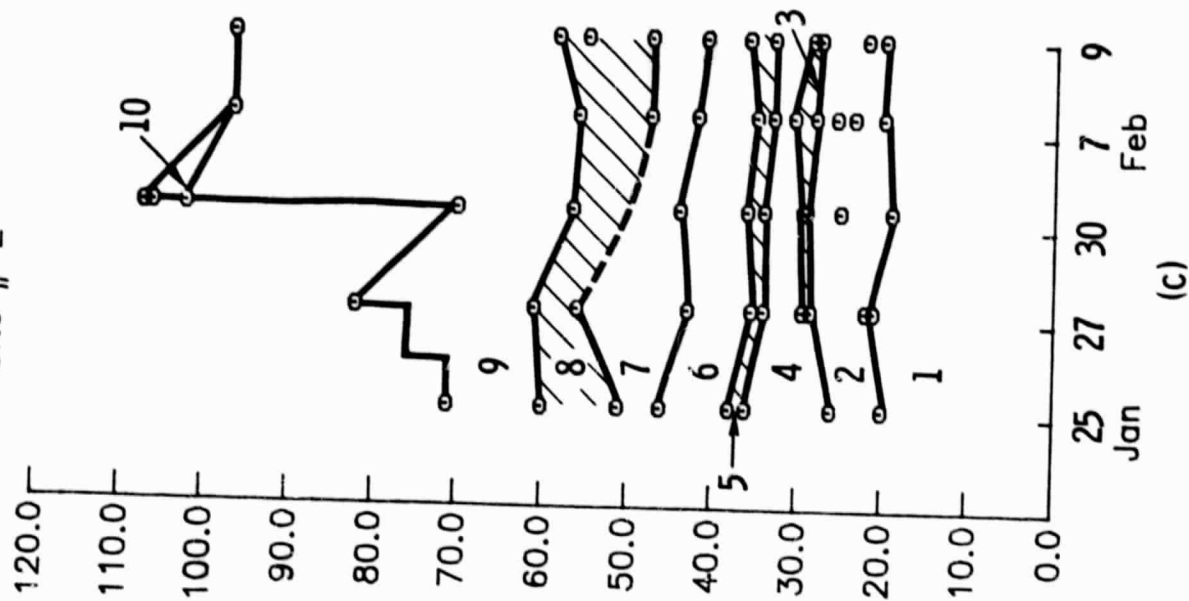
Stratification Data
Site # 1, Hibbert 1980



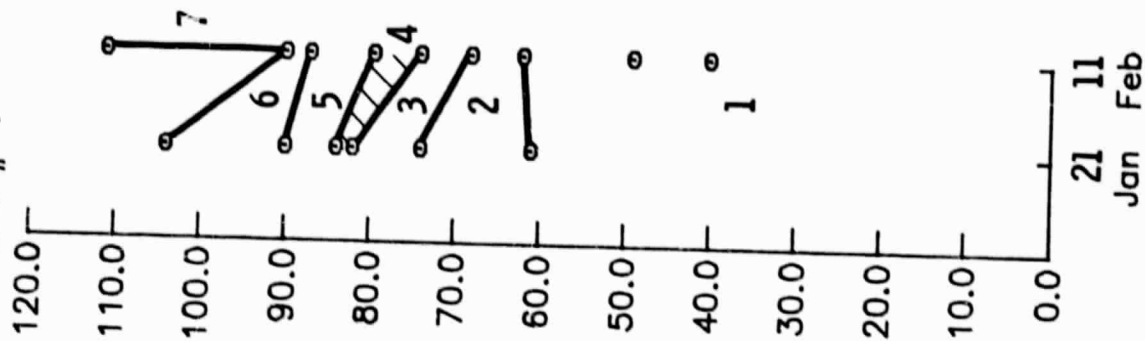
Stratification Data
Winter Park 1979
Site # 4



Stratification Data
Bar Lazy L Ranch 1980
Site # 2



Stratification Data
Rabbit Ears Pass 1980
Site # 3



layers, however, in some cases these layers blended together, thus merging two layers. In this case, the lower layer number was retained. Melting within or at the surface of the snowpack also created new layers that, upon refreezing, became ice or crust layers. Examples of this process were observed in the creation of Layer 4 at Site #1 and Layer 5 at Site #4. Since layers could be formed in the interior of the snowpack, there were, at times, missing layer numbers in the stratification profile. Layers could also merge through crystal metamorphism as Layer 1 and Layer 2 at Site #1, resulting in other missing layers. The extra stratification points shown in Figure 3.1 emanate from very detailed observations made by certain ground-truth personnel and have been tabulated as layer subintervals. The water equivalent data as calculated from the overall snowpack are given in Figure 3.2. New snowfall amounts measured in water equivalent are represented by arrows in the figure.

Since the stratification did not change rapidly, these groups of measurements usually were obtained in the morning and evening hours of the radar acquisition dates. All processed stratification data are included as Appendix A2, while the unprocessed data and field notes are given in Appendix A7.

3.3.2 Temperature Profiles

Snow, air, and ground temperatures were measured periodically with a Markson Scientific hand-held digital thermometer (Model 5650). The interval of measurement within the snowpack was small near the surface and was increased with increasing depth. The temperature data that were obtained at approximately 45-minute intervals are included as Appendix A3.

Stratification Data 1979
Site: 4 (Winter Park)

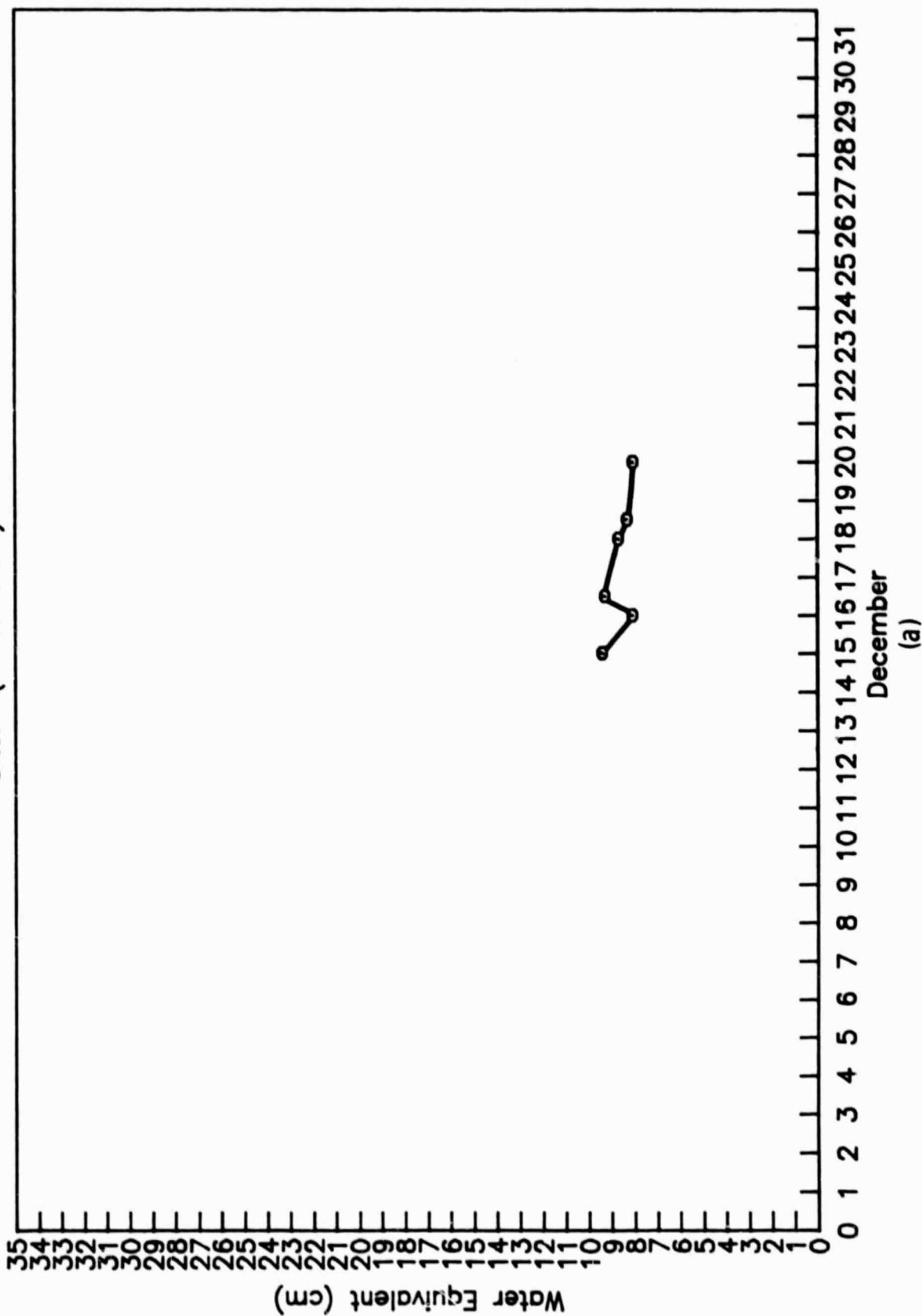
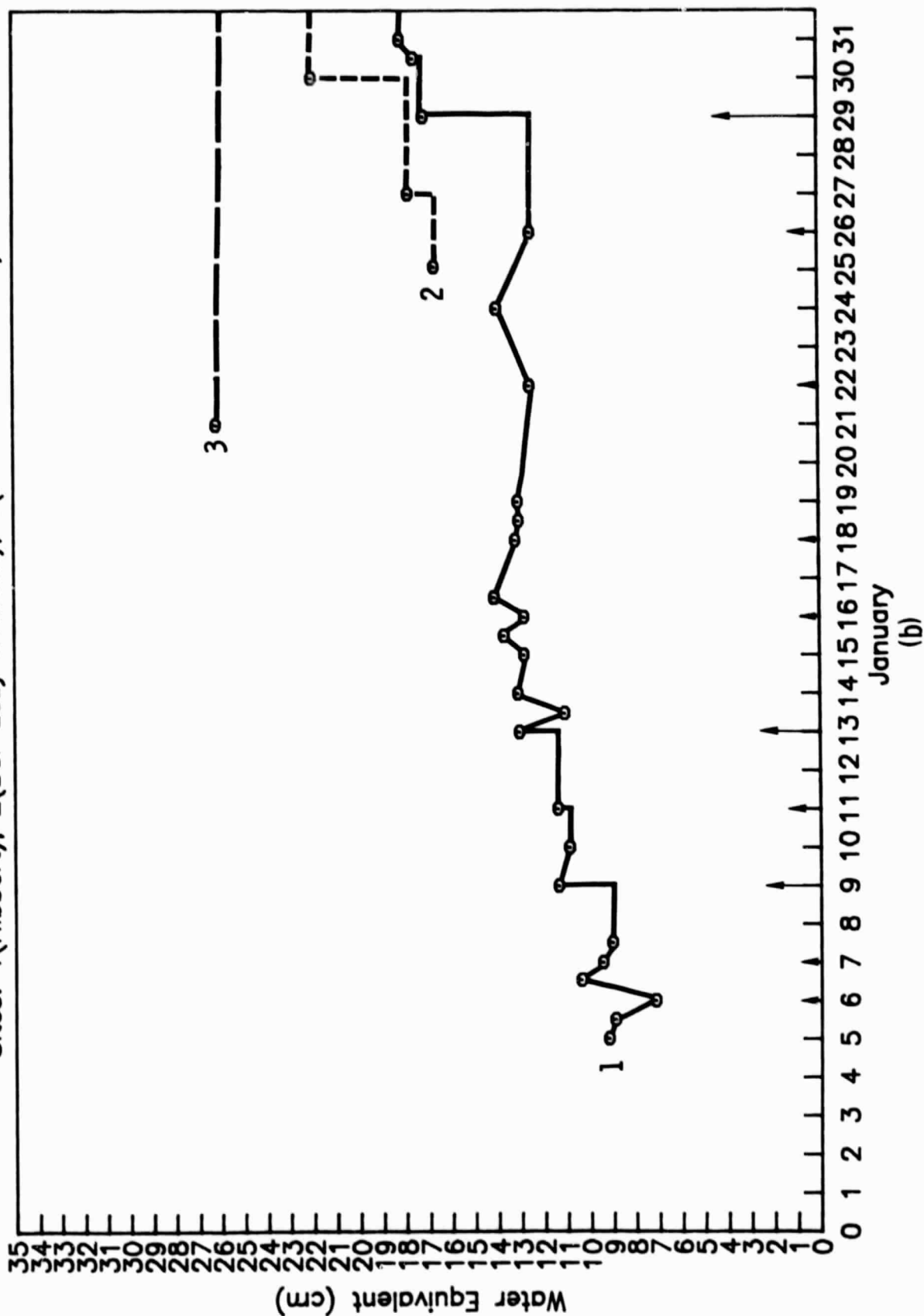
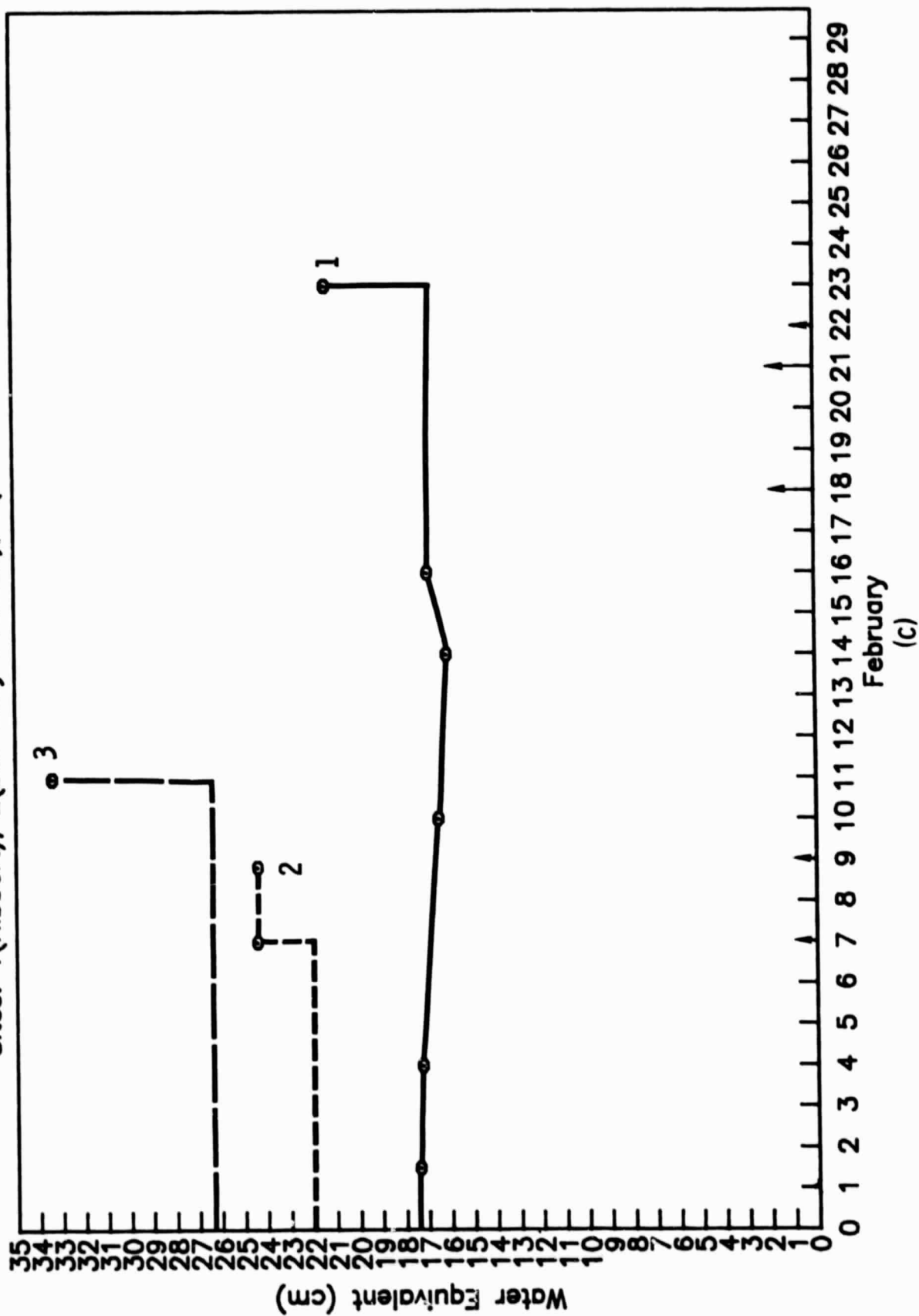


Figure 3.2. Water equivalent data for all test sites during (a) December 1979, (b) January 1980 and (c) February 1980. New snowfall measured in water equivalent is illustrated by the magnitude of the arrows.

Stratification Data 1980
 Sites: 1(Hibbert), 2(Bar Lazy L Ranch), 3(Rabbit Ears Pass)



Stratification Data 1980
 Sites: 1(Hibbert), 2(Bar Lazy I Ranch), 3(Rabbit Ears Pass)



3.3.3 Snow Grain Size

Snow grain size was estimated visually. The sizes given in Figure 3.3 are representative of the larger snow crystals' diameters for each layer. Most crystals had diameters that fell between the value given and one-half of that value. For the ice and crust layers, this size may not be accurate because of the difficulty in separating grain and grain-cluster sizes.

3.3.4 Snow Liquid Water

Snow liquid water content was measured with a freezing calorimeter which is an insulating container with provisions for monitoring temperature. A known amount of very cold silicone oil is added to the calorimeter and the temperature monitored as a function of time. After a set interval, the snow sample, also of known amount, is added to the cold silicone oil. The temperature is again monitored as a function of time and using the methods described in previous papers [3,5], the snow liquid water content can be calculated. The following equation was used to calculate the liquid water content m_v in percent by volume:

$$m_v(\%) = 100 \rho_s \left[\frac{(W_{si} + E)(T_f C_{fsi} - T_i C_{isi})}{W_s L_f} + \frac{(T_f C_{fs} - T_s C_s)}{L_f} \right] \quad (3-3)$$

where

W_{si} = weight of silicone oil, gms

E = calorimeter constant, gms

W_s = weight of snow, gms

L_f = latent heat of fusion of water, cal/gm

ρ_s = snow density gm/cm³

Stratification Data
Site # 1, Hibbert 1980

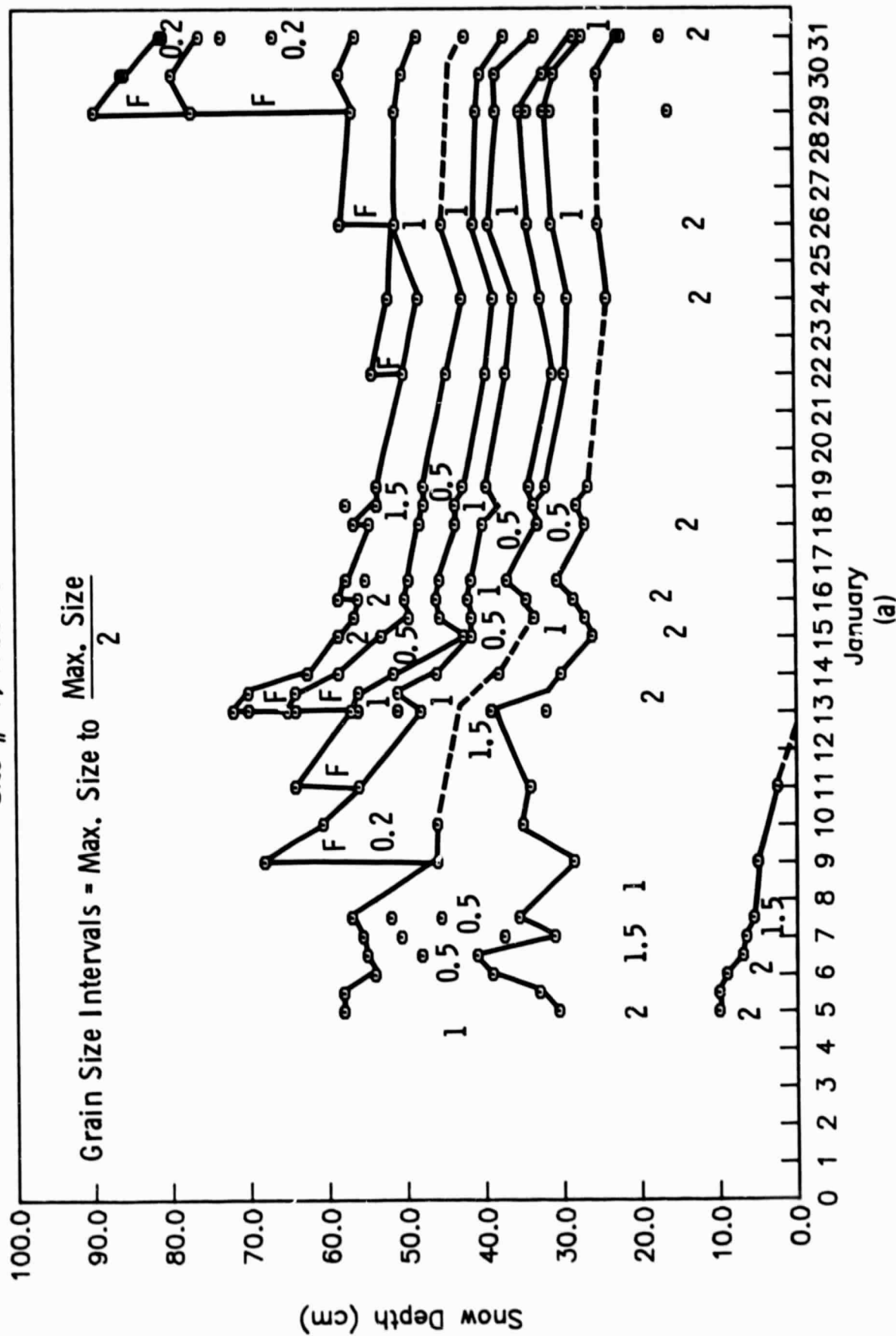
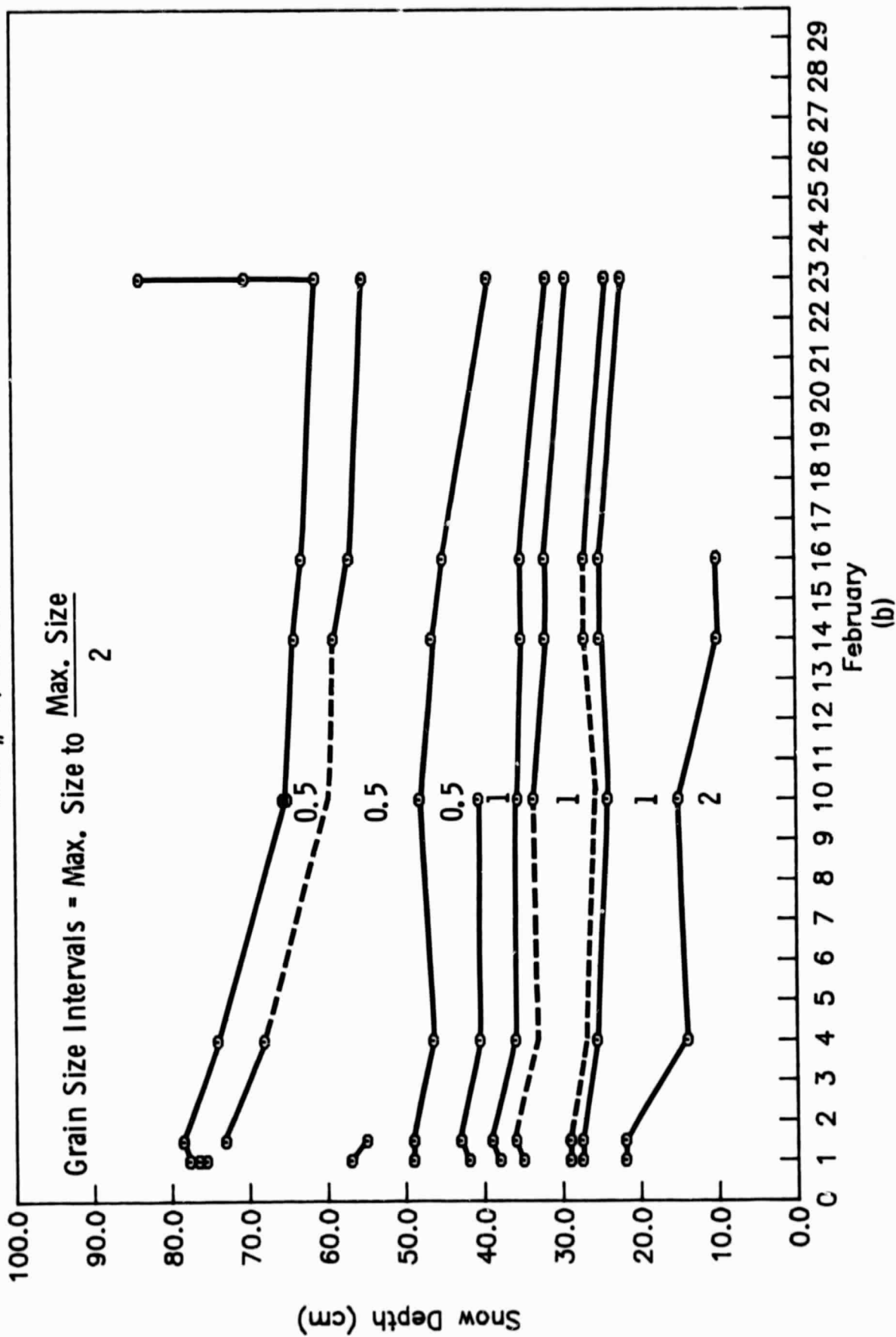
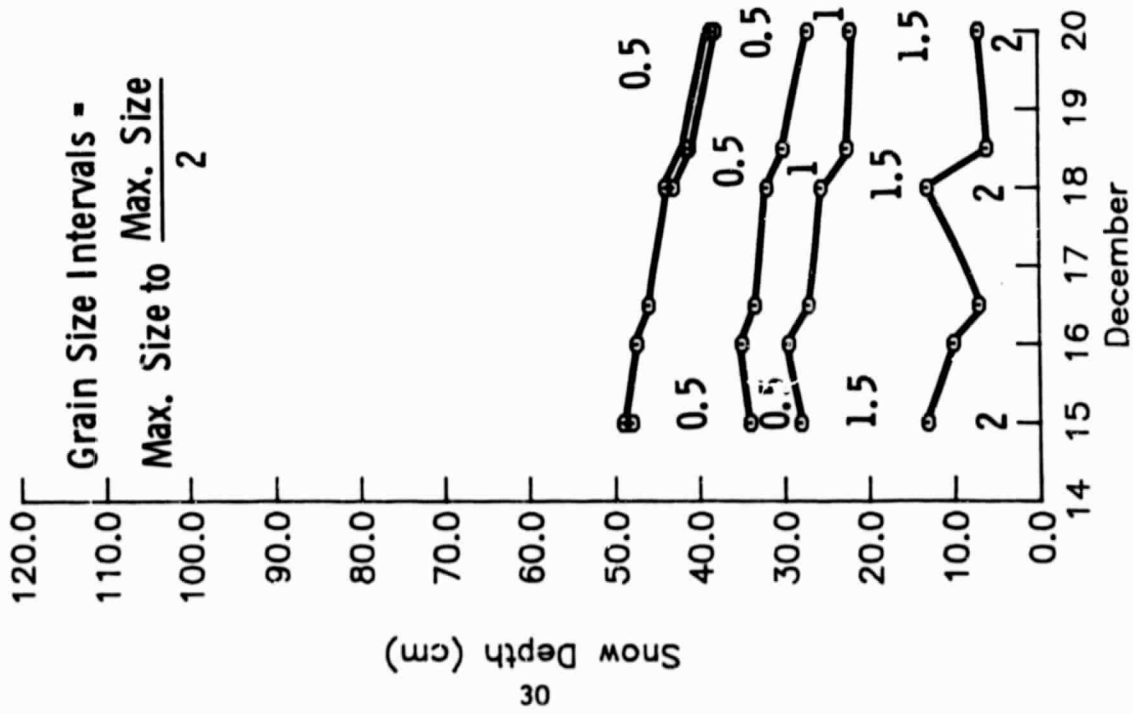


Figure 3.3. Maximum observed snow grain size for the snowpack, with the majority of the grain sizes being between this value and one-half of the value. Fresh snow grains were on the order of 0.2 mm in size.

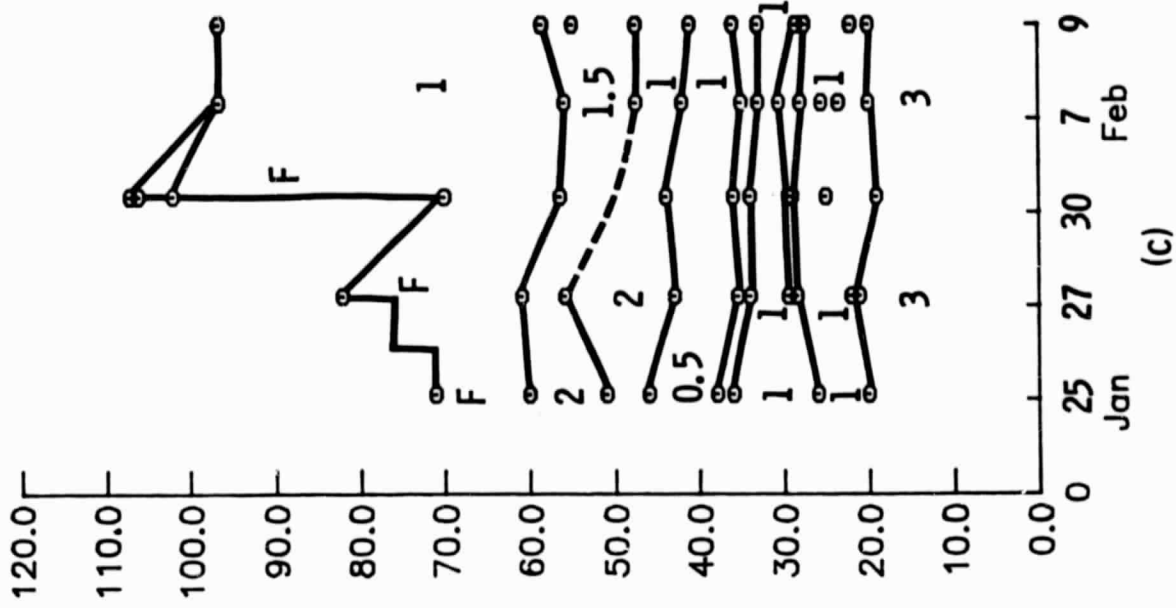
Stratification Data
Site # 1, Hibbert 1980



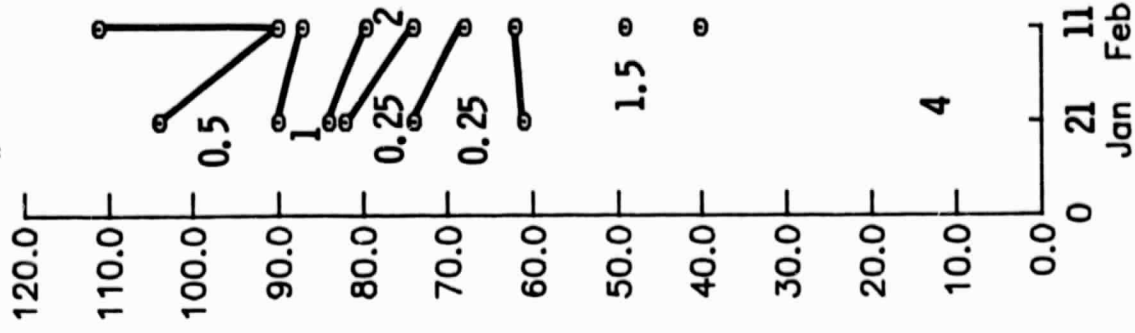
Stratification Data
Winter Park 1979
Site # 4



Stratification Data
Bar Lazy L Ranch 1980
Site # 2



Stratification Data
Rabbit Ears Pass 1980
Site # 3



(c)

T_f = final temperature of solution, °C

T_i = initial temperature of silicone oil, °C

T_s = snow temperature, °C

C_{fsi} = specific heat of silicone oil at T_f , cal/gm/°C

C_{isi} = specific heat of silicone oil at T_i , cal/gm/°C

C_{fs} = specific heat of snow at T_f , cal/gm/°C

C_s = specific heat of snow at T_s , cal/gm/°C

The surface layer has the greatest effect on backscatter therefore it was monitored most often. In previous experiments, the reported surface liquid water content was actually an average over 0 to 5 cm. It was apparent that this interval was too coarse to explain the varying σ^0 responses as functions of frequency [3] and therefore it was decided to monitor m_v in the following intervals near the surface: 0-2 cm, 2-5 cm and 5-10 cm. Appendix A4 contains all of the acquired liquid water content data in both percent by volume (most often used) and percent by weight. The time interval was approximately 30 minutes between samples.

3.3.5 Snow Surface Roughness

The snow surface roughness was photographed when there were wind-induced features that were recognizable against a 1-inch grid. Unfortunately, some of the film on which these photographs were taken was bad and some information was lost. Figure 3.4 shows an example of the roughness at Site 4, Winter Park, on 12/15/79. All other available photographs and observation when photographs were not available are contained in Appendix A5.

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BLACK AND WHITE PHOTOGRAPH

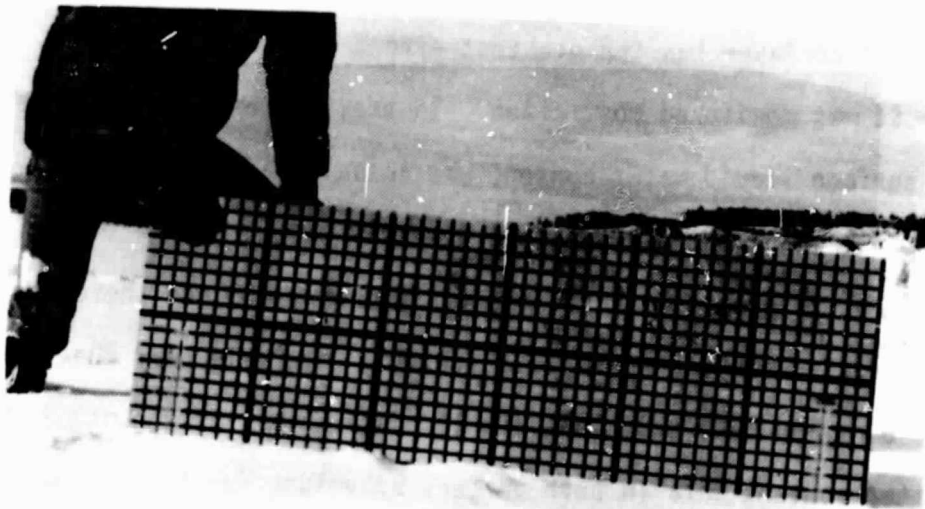


Figure 3.4. Photograph of the snow surface roughness on 12/15/79 at Test Site #4 using a 2 cm x 2 cm grid.

3.4 Soil Data

The radar response to soils is determined by moisture content, frozen or thawed state, vegetation cover, roughness, and temperature, among other factors. The vegetation cover for all fields was in a dormant winter state and the roughness was not measured, however, the general characteristics were furnished in Section 2.

The soil temperature was monitored in the process of obtaining snow temperature profiles. Temperatures were obtained at the soil surface and at 2 cm and 5 cm below the surface. These data were presented in Appendix A3.

The soil state (frozen or thawed) was monitored daily and when thawed was sampled periodically. Gravimetric soil moisture m_{sg} , on a percent dry-weight basis, is given by

$$m_{sg} = \frac{W_{wet} - W_{dry}}{W_{dry}} \times 100 \quad (3-4)$$

where W_{wet} is the sample's wet weight and W_{dry} is the sample's dry weight. Figure 3.5 gives the soil moisture contents.

4.0 RADAR DATA

The radar data were acquired over the period from December 15, 1979 to February 23, 1980. The University of Kansas MAS 1-8 and MAS 8-18/35 systems were employed to obtain backscatter data over the 1-35 GHz frequency interval.

4.1 System Descriptions

The MAS (Microwave Active Spectrometer) 1-8 and MAS 8-18/35 are truck-mounted, multi-frequency, multi-polarization, FM-CW radar systems.

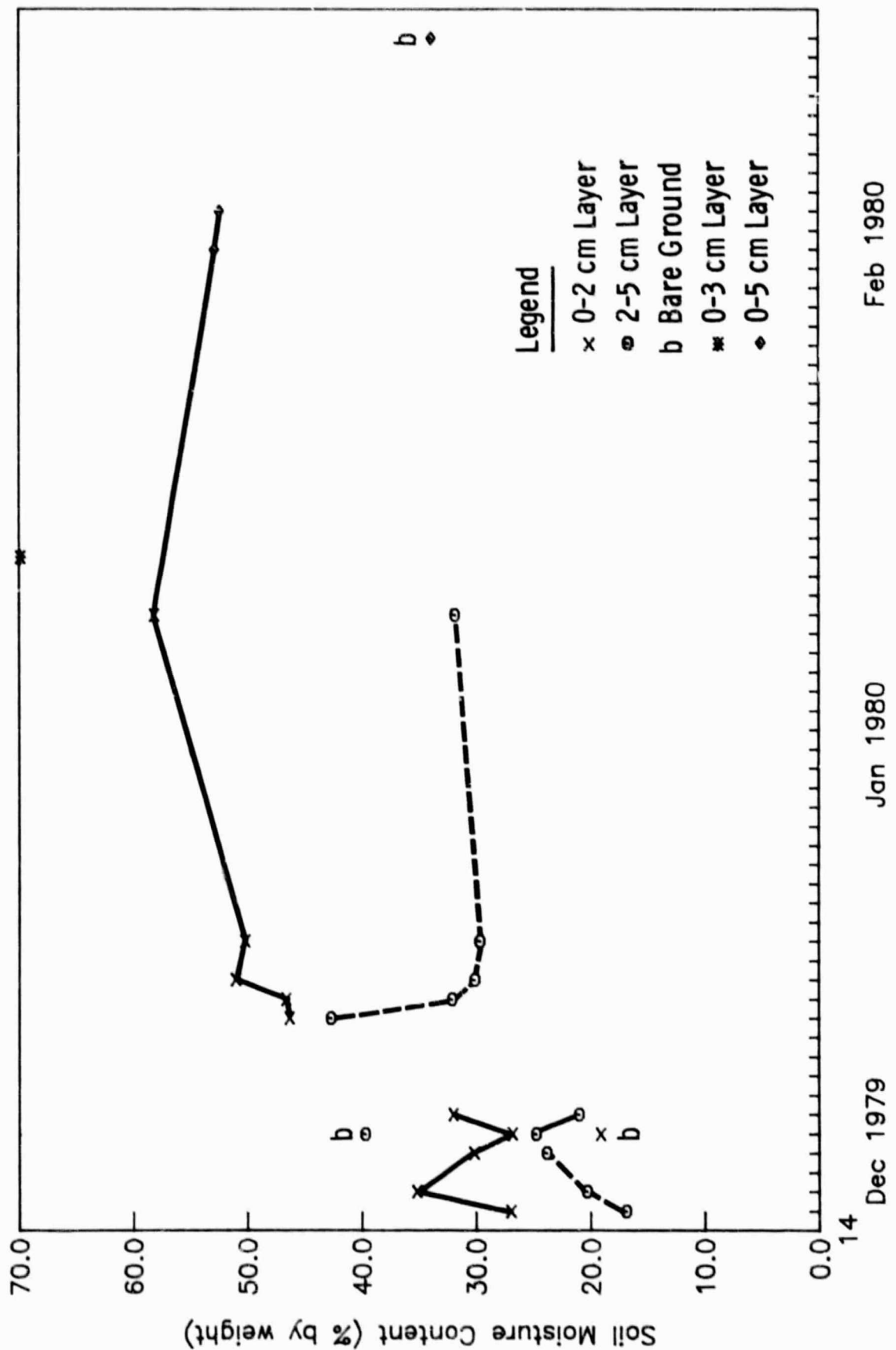


Figure 3.5. Soil moisture contents in percent by dry weight.

These systems are calibrated to make absolute radar cross-section measurements by comparison of the target return power to the power returned from a Luneberg lens reflector which has been calibrated against a metal plate. Short-term calibration is accomplished by referencing the target return power to the power through a coaxial line of known loss and delay. The rf portions of the radars are mounted atop a hydraulic boom at a height of approximately 20 meters. While in previous experiments both systems were independent, for this program both systems were integrated onto a single boom and were operated together. Conversion of the radars from two-antenna to single-antenna configurations facilitated that above-noted modification. System specifications are given in Table 4.1. Figure 4.1a shows the rf portions on the boom with the NASA C-130 airplane in the background. More detail on these systems is available in the documentation reports [6-8]. Figure 4.1b shows the boom-truck and instrumentation van at Site 4 at Winter Park, Colorado. The instrumentation van houses the operator's console and the computer and data processing equipment.

The following equation is used to calculate the backscattering coefficient σ^0 from the received powers:

$$\begin{aligned} \sigma^0(\text{dB}) = & 20 \log \left(\frac{V_t}{V_{td}} \right) - 20 \log \left(\frac{V_c}{V_{cd}} \right) \\ & + 10 \log \sigma_c - 20 \log A_{i11} \\ & + 40 \log \left(\frac{R_t}{R_c} \right) \end{aligned} \quad (4-1)$$

where

- $\sigma^0(\text{dB})$ = backscatter coefficient, dB
- V_t = measured voltage from target
- V_{td} = measured voltage from delay line at the time of target measurement.
- V_c = measured voltage from calibration target.
- V_{cd} = measured voltage from delay line at the time of calibration.
- σ_c = radar cross-section of calibration target.
- A_{ill} = illuminated area
- R_t = range to target
- R_c = range to calibration target

4.2 Data Acquisition Procedure

Radar data sets generally covered the frequencies and polarizations given in Table 4.1 while observing only 0° (nadir), 20° , 50° , and 70° angles of incidence. With a coherent radar system, spatial averaging must be employed to reduce the effects of fading and to obtain a reasonable confidence interval around the mean σ^0 value. The return powers were averaged for 25 resolution cells at 0° and a decreasing number at other angles to a minimum of 10 resolution cells at angles of 60° and above. Frequency averaging (over the FM bandwidth) at the higher incidence angles keeps the number of independent samples always considerably greater than 25.

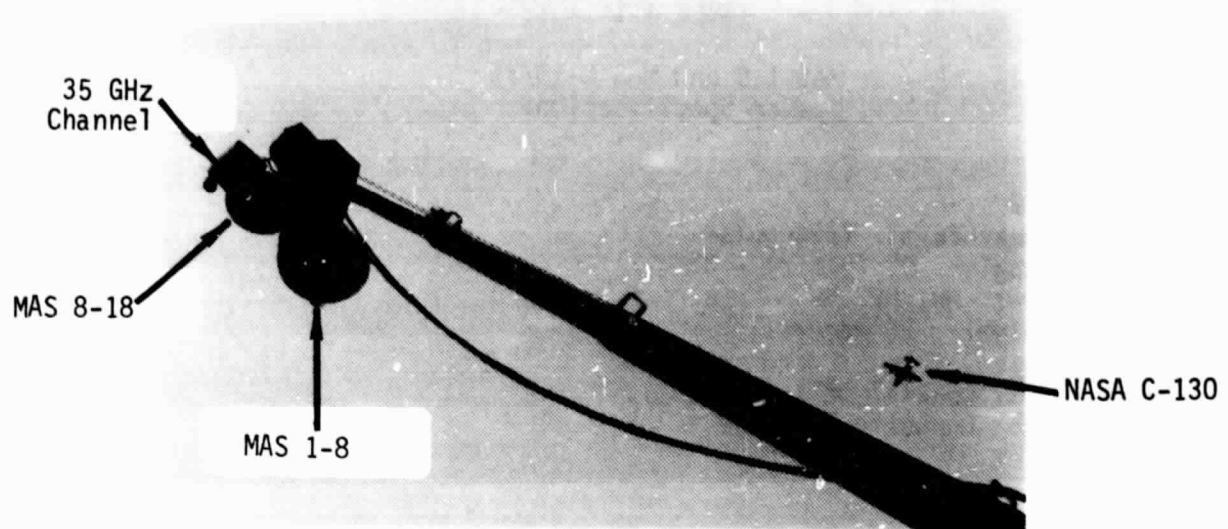
For any given data set, the radar systems were set on the lowest observed angle of incidence, ususally 0° , and all spatial samples were obtained for each frequency/polarization combination. The average values were calculated and the angle start-time recorded. Then the radars were pointed to the next angle and the same procedure

TABLE 4.1

MAS 1-8 and MAS 8-18/35
System Specifications

Type: FM-CW
 Modulating Waveform: Triangular
 Incidence Angle: 0° (nadir) - 85°
 Polarization: HH, HV, VV
 Platform Height: 20 meters
 Calibration:
 Internal: Coaxial delay line
 External: Luneberg lens

System	MAS 1-8	MAS 8-18	35 GHz Channel
Antennas:	Single	Single	Dual
Type	122 cm reflector	91 cm reflector	Scalar horn
Feed	Crossed log-periodic	Quad-ridged horn	-----
Beamwidth	6.3° @ 1.6 GHz to 2.3° @ 8.4 GHz	2.5° @ 8.6 GHz to 1.4° @ 17.0 GHz	3°
Frequencies:	1.6, 2.5, 4.4 GHz	8.6, 13.0, 17.0 GHz	35.6 GHz
Intermediate			
Frequency:	50 KHz	50 KHz	1 GHz, 50 KHz
IF bandwidth:	10 KHz	10 KHz	800 MHz, 10 KHz
FM bandwidth:	250 MHz	800 MHz	800 MHz



(a)



(b)

Figure 4.1. Photographs of the MAS systems illustrating (a) the RF-sections mounted on the hydraulic boom with the NASA C-130 in the background and (b) the boom truck and instrumentation van at Test Site #4.

repeated. At the end of the set, ranges to target, areas of illumination and backscatter coefficient σ^0 were calculated. During several mini-diurnal experiments, the number of angles observed was reduced to one, usually 50° , so that better time-resolution could be obtained with the radar measurements.

The radar data are listed in Appendix B.

5.0 SUMMARY

This report documents the experiment performed during the winter of 1979 - 1980 in the Colorado Rocky Mountains to investigate to radar response to snow parameters. Although all the details concerning the data acquisition techniques are not given, it is hoped that the summaries are sufficient for the investigator in this field. References are furnished for one who wishes more detailed information.

A follow on report is in progress that will furnish analyses of these data and give results of modeling efforts of the radar interaction with the snowpack.

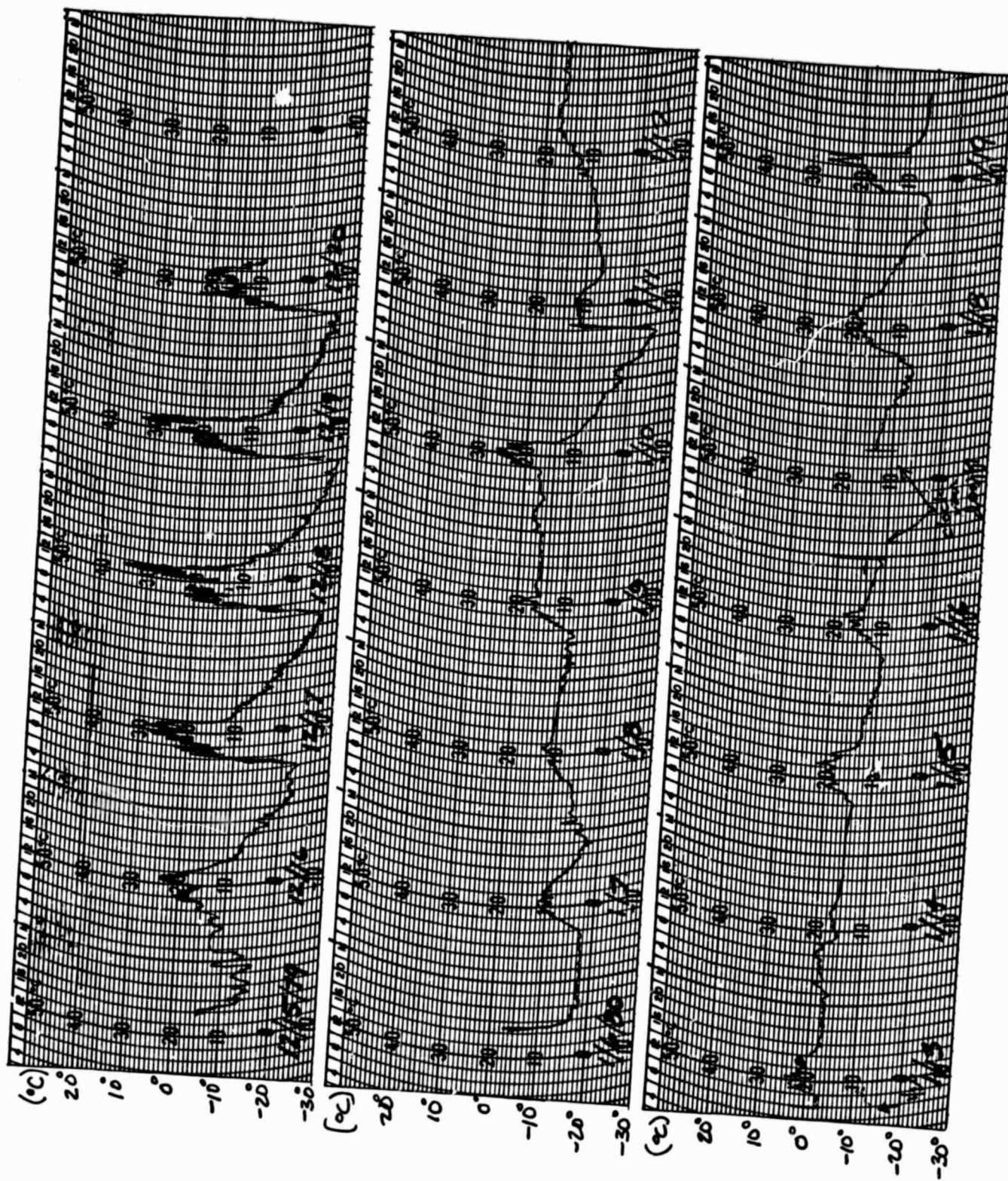
REFERENCES

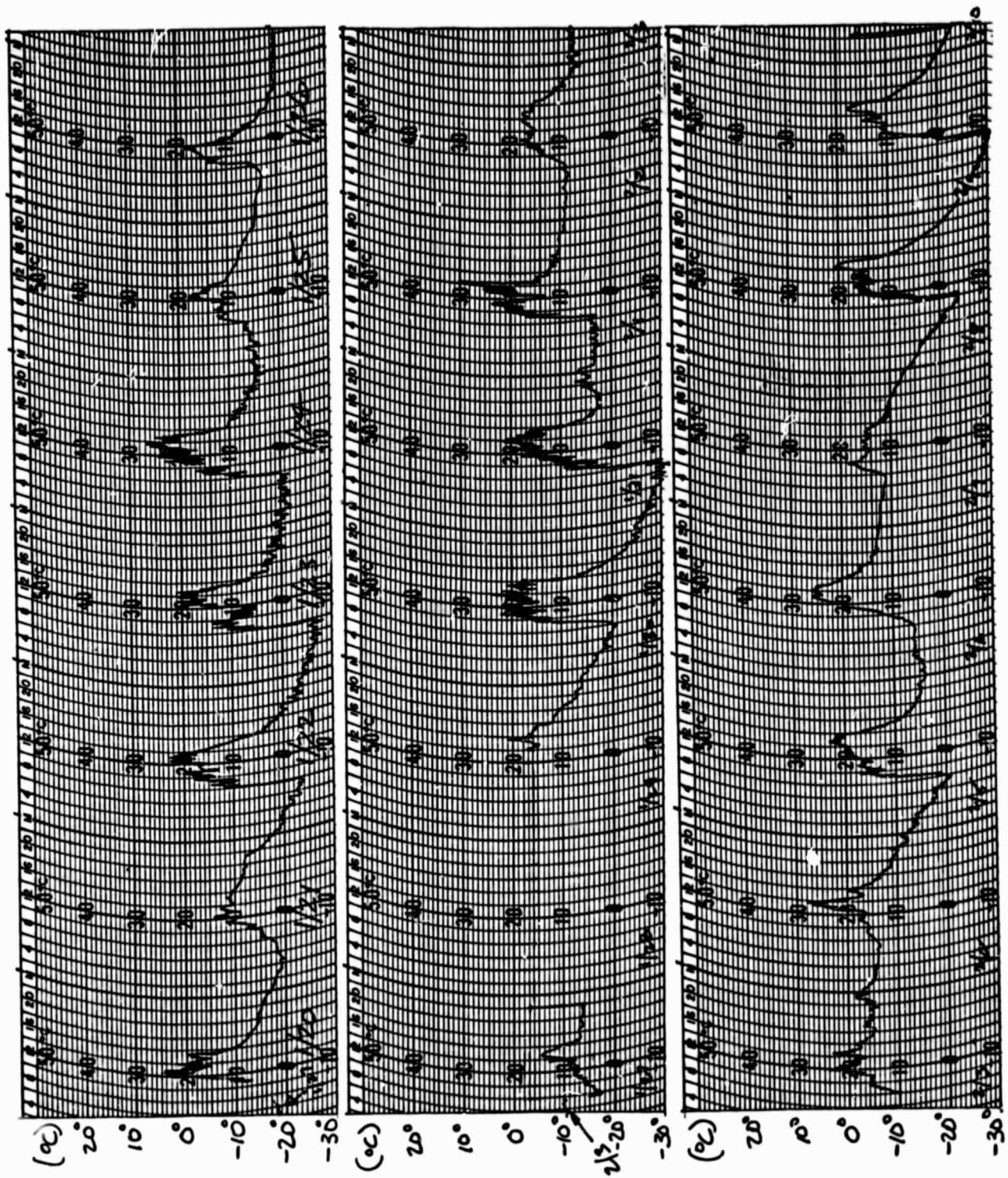
- [1] Stiles, W. H., F. T. Ulaby, B. C. Hanson and L. F. Dellwig, "Snow Backscatter in the 1-8 GHz Region, " RSL Technical Report 177-61, University of Kansas Center for Research, Inc., Lawrence, Kansas, June 1976.
- [2] Stiles, W. H., B. C. Hanson and F. T. Ulaby, "Microwave Remote Sensing of Snow: Experiment Description and Preliminary Results," RSL Technical Report 340-1, University of Kansas Center for Research, Inc., Lawrence, Kansas, June 1977.
- [3] Stiles, W. H. and F. T. Ulaby, "Microwave Remote Sensing of Snowpacks," RSL Technical Report 340-3, University of Kansas Center for Research, Inc., Lawrence, Kansas, June 1980.
- [4] Stiles, W. H., F. T. Ulaby, A. K. Fung and A. Aslam, "Progress in Radar Snow Research," RSL Technical Report 410-1, University of Kansas Center for Research, Inc., March 1981.
- [5] Jones, E. B., A. Rango and S. Howell, "Measurement of Liquid Water Content in a Melting Snowpack Using Cold Calorimeter Techniques," in Proceedings of Microwave Remote Sensing of Snowpack Properties, Ft. Collins, Colorado, NASA Conference Publication 2153, May 1980.
- [6] Stiles, W. H., D. Brunfeldt and F. T. Ulaby, "Performance Analysis of the MAS (Microwave Active Spectrometer) Systems: Calibration, Precision and Accuracy," RSL Technical Report 360-4, University of Kansas Center for Research, Inc., Lawrence, Kansas, April 1979.
- [7] Brunfeldt, D. R., F. T. Ulaby and W. H. Stiles, "System Description and Hardware Specification of MAS 1-8, RSL Technical Report 264-17, University of Kansas Center for Research, Inc., Lawrence, Kansas, February 1979.
- [8] Ulaby, F. T., W. H. Stiles, D. R. Brunfeldt and M. E. Lubben, "MAS 8-18/35 GHz Scatterometer," RSL Technical Report 360-5, University of Kansas Center for Research, Inc., Lawrence, Kansas, February 1979.

APPENDIX A1
Meteorological Data

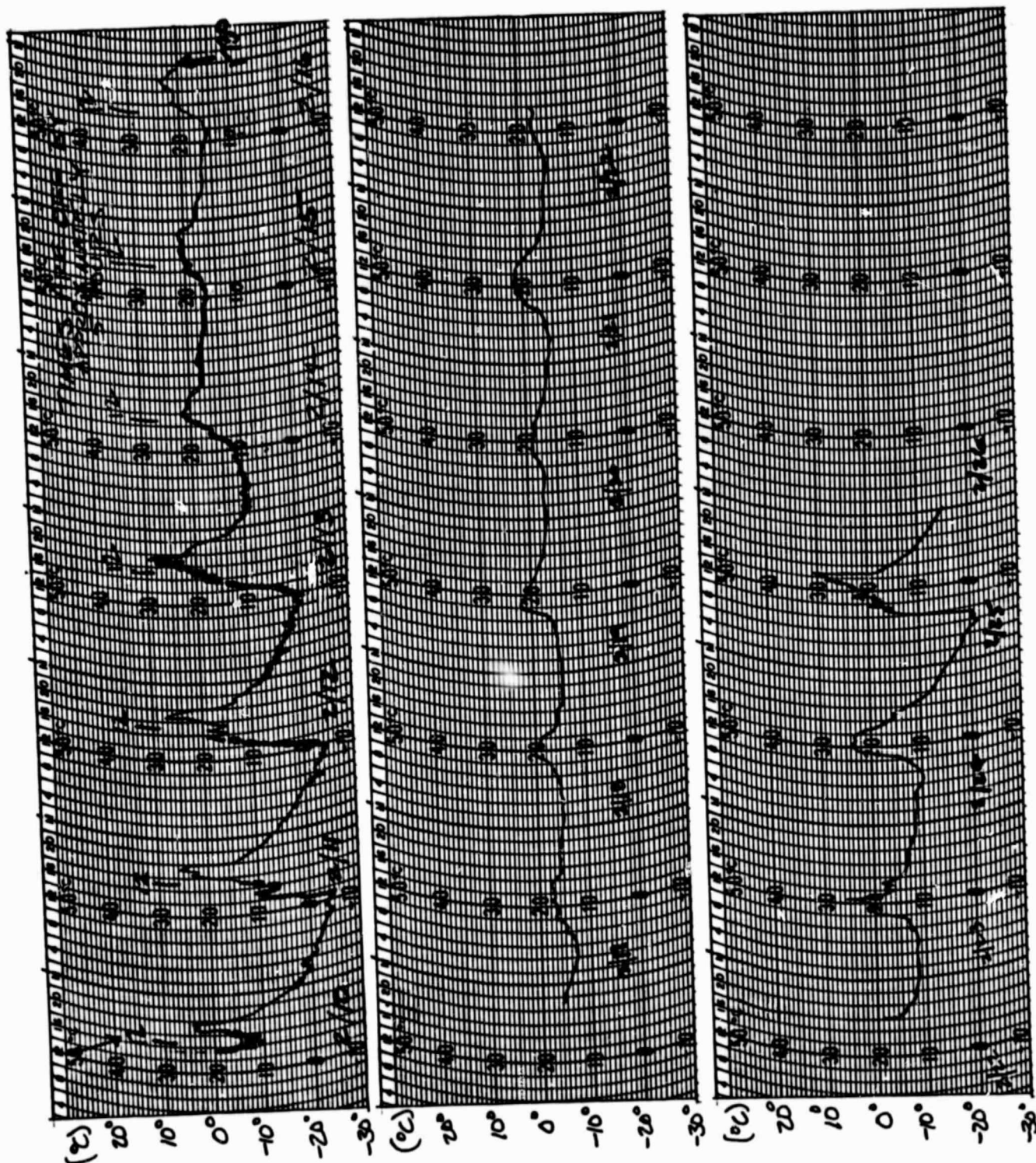
Air temperatures were recorded continuously and although reproduction-quality is poor, they are included as an indication of the thermal history of the snowpack. Note on some dates the time axis is offset. The 1200-hour mark is added and supercedes the standard scale for the period between 2/10/80 and 2/16/80.

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APPENDIX A2

Snow Stratification, Density and Water Equivalent

Layer codes were assigned starting from the ground upwards. Therefore, Layer 1 was assigned closest to the ground. For a given layer, codes are consistent over the season, however, in some cases layers merged and were assigned a single number. Layer 20 is the code assigned to the vertical sample of the whole snowpack used in calculation of water equivalent. A density or water equivalent value of 0.0 indicates that no sample was obtained.

In cases where one layer was multiply sampled, total water equivalent for that layer is given at the uppermost sample within the layer.

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

DATE (mm/dd/yr)	TIME (hours)	TEST SITE	LAYER CODE	LAYER TOP (cm)	LAYER DENSITY (g/cm ³)	WATER EQUIVALENT (cm)
12/15/79	1354	4	20	49.0	0.19	9.38
			4	48.0	0.13	1.76
			3	34.0	0.51	3.04
			2	28.0	0.34	5.10
			1	13.0	0.29	3.71
12/16/79	745	4	20	47.5	0.17	8.05
			4	47.5	0.11	1.45
			3	35.0	0.38	2.10
			2	29.5	0.25	4.79
			1	10.0	0.19	1.89
12/16/79	1435	4	20	46.0	0.20	9.29
			4	46.0	0.13	1.60
			3	33.5	0.39	2.52
			2	27.0	0.24	4.79
			1	7.0	0.18	1.23
12/18/79	930	4	20	44.0	0.20	8.68
			5	44.0	0.20	0.20
			4	43.0	0.20	2.16
			3	32.0	0.50	3.26
			2	25.5	0.32	3.96
12/18/79	1335	4	1	13.0	0.25	3.21
			20	41.5	0.20	8.30
			5	41.5	0.19	0.10
			4	41.0	0.18	1.93
			3	30.0	0.50	3.72
12/20/79	915	4	2	22.5	0.28	4.69
			1	6.0	0.23	1.38
			20	38.5	0.21	8.05
			5	38.5	0.17	0.09
			4	38.0	0.18	1.97
1/ 5/80	1030	1	3	27.0	0.43	2.14
			2	22.0	0.27	3.98
			1	7.0	0.23	1.61
			20	58.0	0.16	9.21
			3	58.0	0.11	2.93
			2	30.5	0.24	5.01
			1	10.0	0.26	2.59

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

DATE (mm/dd/yr)	TIME (hours)	TEST SITE	LAYER CODE	LAYER TOP (cm)	LAYER DENSITY (g/cm ³)	WATER EQUIVALENT (cm)
1/ 5/80	1410	1	20	58.0	0.15	8.93
			3	58.0	0.14	3.46
			2	33.0	0.28	6.37
			1	10.0	0.23	2.29
1/ 6/80	1025	1	20	54.0	0.13	7.19
			3	54.0	0.16	2.35
			2	39.0	0.24	7.26
			1	9.0	0.24	2.15
1/ 6/80	1530	1	20	55.0	0.192	10.57
			3	55.0	0.18	2.54
			3	48.0	0.18	0.00
			2	41.0	0.27	9.10
			1	7.0	0.23	1.62
1/ 7/80	945	1	20	55.5	0.17	9.46
			3	55.5	0.06	4.63
			3	50.6	0.20	0.00
			3	37.5	0.27	0.00
			2	31.0	0.27	6.56
			1	6.5	0.24	1.56
1/ 7/80	1500	1	20	57.0	0.16	9.06
			3	57.0	0.04	3.10
			3	52.0	0.14	0.00
			3	45.5	0.20	0.00
			2	35.5	0.26	7.70
			1	5.5	0.28	1.54
1/ 9/80	1145	1	20	68.0	0.17	11.36
			5	68.0	0.11	2.44
			3	46.0	0.24	4.13
			2	28.5	0.28	6.68
			1	5.0	0.30	1.51
1/10/80	1000	1	20	60.5	0.18	10.90
			5	60.5	0.14	2.05
			3	46.0	0.26	2.81
			2	35.0	0.30	10.49
1/11/80	1300	1	20	64.0	0.18	11.40
			6	64.0	0.15	1.22
			5	56.0	0.22	4.82
			2	34.0	0.28	8.68
			1	2.5	0.22	0.55

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

DATE (mm/dd/yr)	TIME (hours)	TEST SITE	LAYER CODE	LAYER TOP (cm)	LAYER DENSITY (g/cm ³)	WATER EQUIVALENT (cm)
1/13/80	1000	1	20	72.0	0.18	13.05
			8	72.0	0.17	1.22
			7	65.0	0.12	0.95
			6	57.0	0.24	2.16
			5	48.0	0.26	4.10
			2	32.0	0.29	9.18
1/13/80	1410	1	20	70.0	0.16	11.10
			8	70.0	0.21	1.27
			7	64.0	0.14	1.14
			6	56.0	0.33	1.64
			5	51.0	0.25	5.94
			2	39.0	0.28	10.85
1/14/80	1100	1	20	62.5	0.21	13.14
			8	62.5	0.28	1.14
			7	58.5	0.13	0.93
			6	51.5	0.44	2.45
			5	46.0	0.29	2.35
			3	38.0	0.30	2.43
1/15/80	1015	1	2	30.0	0.28	8.20
			20	58.5	0.22	12.83
			8	58.5	0.39	2.16
			7	53.0	0.22	2.33
			6	42.5	0.39	0.39
			5	41.5	0.33	5.09
1/15/80	1445	1	2	26.0	0.27	6.98
			20	56.5	0.24	13.71
			8	56.5	0.37	2.57
			7	49.5	0.25	0.99
			6	45.5	0.31	1.25
			5	41.5	0.32	2.60
1/16/80	950	1	3	33.5	0.33	2.12
			2	27.0	0.29	7.73
			20	58.5	0.22	12.83
			8	58.5	0.13	2.71
			8	56.0	0.39	0.00
			7	50.0	0.24	0.98
			6	46.0	0.66	2.64
			5	42.0	0.30	2.28
			3	34.5	0.31	1.89
			2	28.5	0.37	10.46

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

DATE (mm/dd/yr)	TIME (hours)	TEST SITE	LAYER CODE	LAYER TOP (cm)	LAYER DENSITY (g/cm ³)	WATER EQUIVALENT (cm)
1/16/80	1445	1	20	57.5	0.25	14.13
			8	57.5	0.10	2.44
			8	55.0	0.40	0.00
			7	49.5	0.29	1.17
			6	45.5	0.48	1.91
			5	41.5	0.31	1.41
			3	37.0	0.33	2.14
			2	30.5	0.28	8.44
1/18/80	1010	1	20	56.5	0.23	13.22
			8	56.5	0.13	2.57
			8	54.5	0.36	0.00
			7	48.0	0.25	1.15
			6	43.5	0.54	1.89
			5	40.0	0.31	2.22
			3	33.0	0.33	1.99
			2	27.0	0.31	8.33
1/18/80	1600	1	20	53.5	0.24	13.07
			8	53.5	0.41	2.43
			7	47.5	0.28	1.11
			6	43.5	0.62	3.71
			5	37.5	0.32	1.27
			3	33.5	0.33	1.81
			2	28.0	0.30	8.42
			20	53.5	0.24	13.10
1/19/80	818	1	8	53.5	0.40	2.42
			7	47.5	0.27	1.34
			6	42.5	0.51	1.53
			5	39.5	0.32	1.77
			4	34.0	0.32	0.63
			3	32.0	0.35	1.92
			2	26.5	0.27	7.24
			20	104.0	0.25	26.17
1/21/80	1445	3	6	104.0	0.17	2.33
			5	90.0	0.31	1.88
			4	84.0	0.48	0.96
			3	82.0	0.28	2.26
			2	74.0	0.39	5.06
			1	61.0	0.37	22.52

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

DATE (mm/dd/yr)	TIME (hours)	TEST SITE	LAYER CODE	LAYER TOP (cm)	LAYER DENSITY (g/cm ³)	WATER EQUIVALENT (cm)
1/22/80	1130	1	20	54.0	0.23	12.53
			9	54.0	0.08	0.33
			8	50.0	0.37	2.04
			7	44.5	0.26	1.32
			6	39.5	0.25	0.64
			5	37.0	0.32	1.91
			4	31.0	0.28	0.41
			3	29.5	0.32	9.33
			20	52.0	0.27	13.96
1/24/80	1145	1	9	52.0	0.20	0.78
			8	48.0	0.47	2.56
			7	42.5	0.28	1.13
			6	38.5	0.35	0.87
			5	36.0	0.34	1.18
			4	32.5	0.57	2.00
			3	29.0	0.35	1.75
			2	24.0	0.28	6.74
			20	71.0	0.23	16.60
1/25/80	1150	2	9	71.0	0.07	0.77
			8	60.0	0.38	3.42
			7	51.0	0.48	2.41
			6	46.0	0.31	2.49
			5	38.0	0.21	0.41
			4	36.0	0.36	3.59
			2	26.0	0.52	3.13
			1	20.0	0.36	7.16
			20	58.0	0.22	12.51
1/26/80	1225	1	9	58.0	0.24	1.67
			8	51.0	0.28	1.69
			7	45.0	0.27	1.07
			6	41.0	0.20	0.39
			5	39.0	0.33	1.66
			4	34.0	0.21	0.57
			4	32.0	0.14	0.00
			3	31.0	0.35	2.08
			2	25.0	0.29	7.30

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

DATE (mm/dd/yr)	TIME (hours)	TEST SITE	LAYER CODE	LAYER TOP (cm)	LAYER DENSITY (g/cm ³)	WATER EQUIVALENT (cm)
1/27/80	1208	2	20	82.0	0.22	17.78
			9	82.0	0.09	1.97
			8	61.0	0.24	1.20
			7	56.0	0.37	4.76
			6	43.0	0.34	2.54
			5	35.5	0.26	0.39
			4	34.0	0.41	1.86
			3	29.5	0.36	0.32
			2	28.5	0.35	2.62
			2	22.0	0.36	0.00
			1	21.0	0.27	5.77
			20	89.5	0.19	17.11
			11	89.5	0.09	1.15
1/29/80	1155	1	10	77.0	0.14	2.87
			9	56.5	0.19	1.05
			8	51.0	0.40	4.20
			6	40.5	0.32	0.81
			5	38.0	0.28	0.85
			4	35.0	0.45	1.35
			4	34.0	0.45	0.00
			3	32.0	0.45	5.59
			3	31.0	0.34	0.00
			2	16.0	0.28	4.42
			20	106.0	0.21	21.98
			10	107.0	0.18	0.91
			9	102.0	0.15	7.64
1/30/80	900	2	9	70.0	0.20	0.00
			8	56.5	0.44	5.44
			6	44.0	0.34	2.70
			5	36.0	0.37	0.74
			4	34.0	0.55	2.49
			3	29.5	0.55	0.28
			2	29.0	0.33	4.26
			2	25.0	0.49	0.00
			1	19.0	0.37	7.04

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

DATE (mm/dd/yr)	TIME (hours)	TEST SITE	LAYER CODE	LAYER TOP (cm)	LAYER DENSITY (g/cm ³)	WATER EQUIVALENT (cm)
1/30/80	1500	1	20	86.0	0.20	17.54
			12	86.0	0.06	0.03
			11	85.5	0.19	1.16
			10	79.5	0.16	3.49
			9	58.0	0.21	1.69
			8	50.0	0.40	4.04
			6	40.0	0.32	0.64
			5	38.0	0.37	2.22
			4	32.0	0.45	0.90
			3	30.0	0.34	1.70
			2	25.0	0.28	7.00
			20	81.0	0.22	18.12
			12	81.0	0.05	0.03
			11	80.5	0.18	0.81
1/31/80	1340	1	10	76.0	0.12	3.36
			10	73.0	0.19	0.00
			10	66.5	0.17	0.00
			9	56.0	0.23	1.82
			8	48.0	0.38	2.30
			7	42.0	0.32	1.60
			6	37.0	0.37	1.48
			5	33.0	0.45	2.25
			4	28.0	0.45	0.45
			3	27.0	0.28	1.54
			2	22.5	0.28	6.30
			2	22.0	0.28	0.00
			2	17.0	0.28	0.00
			20	77.7	0.00	0.00
2/ 1/80	1100	1	12	76.5	0.00	0.00
			11	75.5	0.00	0.00
			~	57.0	0.00	0.00
			8	49.0	0.00	0.00
			7	42.0	0.00	0.00
			6	38.0	0.00	0.00
			5	35.0	0.00	0.00
			4	29.0	0.00	0.00
			3	27.5	0.00	0.00
			2	22.0	0.00	0.00

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

DATE (mm/dd/yr)	TIME (hours)	TEST SITE	LAYER CODE	LAYER TOP (cm)	LAYER DENSITY ³ (g/cm ³)	WATER EQUIVALENT (cm)
2/ 1/80	1500	1	20	78.5	0.22	17.38
			12	78.5	0.11	0.60
			10	73.0	0.19	3.47
			9	55.0	0.27	1.61
			8	49.0	0.41	2.43
			7	43.0	0.32	1.28
			6	39.0	0.32	0.96
			5	36.0	0.37	2.59
			4	29.0	0.45	1.19
			3	27.5	0.28	1.54
			2	22.0	0.28	6.16
			20	74.0	0.23	17.23
			11	74.0	0.22	1.30
2/ 4/80	1300	1	9	68.0	0.25	5.36
			8	46.5	0.40	2.42
			7	40.5	0.32	1.43
			6	36.0	0.72	7.58
			3	25.5	0.41	4.75
			2	14.0	0.34	4.72
			20	96.5	0.25	24.41
			9	96.5	0.22	10.70
			8	56.0	0.39	3.31
			7	47.5	0.47	2.59
2/ 7/80	1460	2	6	42.0	0.37	2.59
			5	35.0	0.37	0.68
			4	33.0	0.37	0.93
			3	30.5	0.37	0.74
			2	28.0	0.37	3.32
			2	25.5	0.37	0.00
			2	23.5	0.37	0.00
			1	20.0	0.37	7.40

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

DATE (mm/dd/yr)	TIME (hours)	TEST SITE	LAYER CODE	LAYER TOP (cm)	LAYER DENSITY (g/cm ³)	WATER EQUIVALENT (cm)
2/ 9/80	1452	2	20	96.5	0.25	24.02
			9	96.5	0.28	11.55
			9	58.5	0.23	0.00
			8	55.0	0.40	3.03
			7	47.5	0.53	3.48
			6	41.0	0.36	1.81
			5	36.0	0.72	2.16
			4	33.0	0.40	1.82
			3	28.5	0.37	0.37
			2	27.5	0.37	2.78
			2	22.0	0.37	0.00
			1	20.0	0.37	7.40
			20	65.5	0.25	16.48
			11	65.5	0.26	4.55
2/10/80	1315	1	11	65.0	0.26	0.00
			8	48.0	0.26	1.95
			7	40.5	0.33	1.63
			6	35.5	0.32	0.64
			5	33.5	0.35	3.28
			3	24.0	0.41	3.67
			2	15.0	0.31	4.61
			20	111.0	0.30	33.38
			7	111.0	0.30	6.27
			6	90.0	0.32	0.97
2/11/80	1330	3	5	87.0	0.36	2.73
			4	79.5	0.38	2.10
			3	74.0	0.46	2.76
			2	68.0	0.39	2.36
			1	62.0	0.41	24.68
			1	49.0	0.36	0.00
			1	40.0	0.40	0.00

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

DATE (mm/dd/yr)	TIME (hours)	TEST SITE	LAYER CODE	LAYER TOP (cm)	LAYER DENSITY (g/cm ³)	WATER EQUIVALENT (cm)
2/14/80	1245	1	20	64.0	0.251	16.10
			11	64.0	0.226	1.13
			9	59.0	0.214	2.67
			7	46.5	0.335	3.85
			6	35.0	0.414	1.24
			5	32.0	0.313	1.56
			4	27.0	0.400	0.80
			3	25.0	0.279	4.18
			2	10.0	0.246	2.46
			20	63.0	0.268	16.90
2/16/80	1400		11	63.0	0.350	2.10
			9	57.0	0.214	2.57
			7	45.0	0.322	3.22
			6	35.0	0.408	1.22
			5	32.0	0.331	1.65
			4	27.0	0.400	0.80
			3	25.0	0.279	4.18
			2	10.0	0.246	2.46
			20	83.5	0.25	21.28
			12	83.5	0.16	4.86
2/23/80	1330	1	12	70.0	0.31	0.00
			11	61.0	0.36	2.17
			9	55.0	0.34	5.50
			7	39.0	0.41	3.04
			6	31.5	0.25	0.63
			5	29.0	0.48	2.59
			4	24.0	0.15	0.30
			2	22.0	0.36	7.92

APPENDIX A3

Snow Temperature Profiles

Temperature data is given in degrees Celsius by date and time. "L" refers to the profile measurement location with 1 indicating the left-hand side of the observation area and 3 indicating the right-hand side. Temperatures were measured in coarse increments AGL (above ground level) and in the soil. In addition, in the snow BSS (below snow surface), the temperature was measured with better resolution, especially near the surface. Air temperature was also recorded.

WINTER PARK, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 4

DATE: 12/15/79

TIME OF DAY (HOURS)

1540 1640
L 3 3

DEPTH

AGL(cm)

100

39 -4.9 -7.4

0 -2.4 -2.8

-1 -1.7 -2.1

-5

DEPTH

BSS(cm)

0

-2 -4.9 -7.4

-5 -5.9 -7.4

-10 -6.4 -6.6

-20 -6.0 -5.5

-30 -3.3 -4.2

AIR -4.0 -2.1

DATE: 12/16/79

0800 0830 0900 0930 1000 1030 1100 1130 1200 1245 1300 1350
L 3 3 3 3 3 3 3 3 3 3 3 3

DEPTH

AGL(cm)

100

40

0 -2.0 -0.5 -0.1 -0.5 -0.5 -0.4 -1.6 -0.8 -0.6 -0.8 -1.2 -0.6

-2

-5

DEPTH

BSS(cm)

0 -5.9

-2 -5.8 -4.7 -4.0 -2.8 -2.6 -2.3 -0.9 -1.7 -0.7 -1.3 -0.2 -1.5

-5 -6.3 -5.1 -4.2 -4.0 -4.1 -3.0 -2.0 -3.2 -2.4 -2.1 -1.4 -1.1

-10 -6.3 -4.9 -4.1 -4.1 -4.5 -3.6 -2.5 -4.1 -3.3 -3.4 -2.3 -2.1

-20 -5.7 -3.8 -3.0 -3.1 -4.1 -3.0 -2.1 -3.9 -4.0 -4.0 -3.0 -3.1

-30 -4.0 -2.1 -1.8 -1.8 -1.9 -1.8 -0.2 -2.3 -3.0 -3.2 -2.8 -2.8

AIR -3.8 -3.8 -3.6 -0.9 -0.8 -0.7 -0.7 -0.0 -0.2 -0.4 0.2 3.6

WINTER PARK, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 4

DATE: 12/16/79

	1435	1600	1630
L	3	3	3
100			
50			
0	-0.4	-1.1	-1.2
-2			
-5			
0			
-2	-1.6	-4.5	-7.5
-5	-3.1	-3.6	-5.0
-10	-3.0	-3.4	-4.2
-20	-3.6	-3.4	-3.9
-30	-2.9	-2.6	-2.6

AIR 5.8 0.0 -0.9

DATE: 12/18/79

	1100	1200	1245	1330	1400	1430	1500	1530	1600	1630	1700
L	3	3	3	3	3	3	3	3	3	3	3

DEPTH

AGL(cm)

100											
50	-12.9	-5.0									
0	-1.6	-0.7	-1.2	-1.7	-1.6	-1.6	-1.1	-0.5	-0.5	-0.8	
-2											
-5											

DEPTH

BSS(cm)

0											
-2	-12.9	-9.5	-6.6	-7.2	-6.3	-6.8	-7.3	-7.7	-8.7	-9.1	
-5	-12.9	-11.0	-9.1	-7.2	-8.1	-8.6	-7.7	-8.1	-8.2	-9.3	
-10	-12.0	-9.6	-9.4	-9.9	-8.0	-9.0	-8.4	-8.2	-7.3	-7.9	
-20	-8.1	-8.4	-6.4	-8.6	-8.6	-7.6	-7.4	-6.8	-5.3	-6.5	
-30	-5.0	-4.9	-4.4	-5.6	-5.6	-4.9	-4.7	-4.8	-2.4	-4.3	

AIR -7.6 -7.0 -6.1 -2.2 1.2 -1.4 -2.6 -3.8 -5.1 -7.2

WINTER PARK, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 4

DATE: 12/20/79

TIME OF DAY (HOURS)

	1200	1330	1450
L	3	3	3

DEPTH

AGL (cm)

100

40

0 -3.6 -2.3 -2.4

-2

-5

DEPTH

BSS (cm)

0

-2 -12.2 -5.3 -6.9

-5 -14.2 -7.8 -9.2

-10 -13.6 -11.0 -9.0

-20 -12.1 -10.3 -6.0

-30 -8.4 -5.8 -4.5

AIR -4.6 -2.5 -0.3

STEAMBOAT SPRINGS, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 1

DATE: 1/ 5/80

TIME OF DAY

1400 1600
L 1 1

DEPTH

AGL(cm)

100

50 -0.1 -4.8

0 -0.4 -0.9

-2

-5

DEPTH

BSS(cm)

0

-2 1.7 -7.8

-5 0.5 -4.8

-10 -1.3 -3.6

-20 -1.8 -2.5

-30 -1.6 -1.6

AIR 1.4 -7.2

DATE: 1/ 6/80

1025 1101 1130 1204 1234 1313 1346 1400 1435 1501 1533
L 1 1 1 1 1 1 1 1 1 1 1

DEPTH

AGL(cm)

100

50 -7.9 -8.2 -6.7 -7.6 -6.0 -6.7 -7.4 -6.9 -8.9 -8.7 -9.6

0 -2.2 -2.3 -4.8 -3.0 -5.8 -5.7 -8.4 -7.4 -7.8 -7.9 -6.0

-2

-5

DEPTH

BSS(cm)

0 -9.4 -8.5 -8.8 -8.6 -9.5 -10.0 -9.5 -9.1 -9.7 -8.8 -10.2

-2 -7.9 -8.2 -6.7 -7.6 -6.0 -6.7 -7.4 -6.9 -8.9 -8.7 -9.6

-5 -7.0 -7.0 -6.5 -7.2 -7.1 -6.2 -6.6 -6.9 -7.3 -7.5 -7.8

-10 -5.5 -5.4 -6.0 -7.3 -5.4 -6.1 -7.1 -7.6 -7.4 -7.7 -7.2

-20 -3.6 -3.4 -6.0 -7.9 -6.8 -7.5 -8.1 -8.2 -8.2 -8.0 -7.9

-30 -2.8 -2.4 -4.7 -8.6 -7.3 -7.9 -8.5 -8.3 -8.2 -8.5 -8.4

AIR -9.5 -9.0 -9.2 -9.1 -9.2 -8.9 -8.2 -8.1 -7.8 -8.1 -8.9

STEAMBOAT SPRINGS, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 1

DATE: 1/ 7/80

TIME OF DAY (HOURS)

	936	1000	1055	1500	1540
L	1	1	1	1	1

DEPTH

AGL(cm)

100

50 -11.7-10.8 -9.7 -4.8 -4.4

0 -3.1 -3.8 -3.4 -1.1 -0.9

-2

-5

DEPTH

BSS(cm)

0 -12.2 -9.4 -6.9 -3.6 -5.0

-2 -11.2-10.4 -8.1 -3.4 -4.4

-5 -11.7-10.8 -9.7 -3.7 -3.7

-10 -11.7-10.5 -9.8 -4.8 -4.4

-20 -11.3 -8.6 -8.5 -5.4 -5.2

-30 -7.9 -6.9 -6.8 -5.0 -4.6

AIR -13.0-12.6 -9.7 -7.0 -6.8

DATE: 1/ 9/80

1110 1140 1205 1240 1350

	1110	1140	1205	1240	1350
L	1	1	1	1	1

DEPTH

AGL(cm)

100

50 -5.9 -4.6 -1.9 -1.1 -3.1

0 -0.8 0.6 1.8 2.1 1.1

-2 1.7 2.4 2.2 3.1

-5 2.1 2.8 2.6 3.4

DEPTH

BSS(cm)

0 -3.1 -3.4 -1.0 1.2

-2 -4.7 -3.9 -1.2 -0.3 -1.7

-5 -5.7 -4.8 -1.9 -0.8 -2.0

-10 -6.5 -5.1 -2.2 -1.0 -2.5

-20 -5.9 -4.6 -1.9 -1.1 -3.1

-30 -4.5 -3.5 -1.0 -0.9 -2.8

AIR -5.7 -3.7 -3.6 1.3 1.2

STEAMBOAT SPRINGS, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 1

DATE: 1/10/80

TIME OF DAY (HOURS)

	1100	1200	1230
L	1	1	1

DEPTH

AGL(cm)

100

50	-1.2	-1.2	-0.4
0	-0.1	-0.6	0.5
-2	0.3	0.3	0.1
-5	0.6		0.4

DEPTH

BSS(cm)

0	-0.2	-0.6	-0.2
-2	-0.1	-0.3	-0.2
-5	-0.3	-0.4	-0.2
-10	-0.8	-0.8	-0.7
-20	-1.5	-1.4	-0.4
-30	-1.2	-1.3	-0.2

AIR	2.4		2.6
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DATE: 1/11/80

	1150	1330	1405	1434	1515	1615
L	1	1	1	1	1	1

DEPTH

AGL(cm)

100

50	-10.7	-9.7	-9.4	-8.7	-8.8	-9.2
0	-0.2	1.3	1.4	1.6	2.4	2.0
-2	1.3	1.2	1.5	1.7		2.1
-5	1.6	1.6	1.9	7.1		2.4

DEPTH

BSS(cm)

0	-10.9	-10.0	-10.2	-9.0	-8.8	-10.9
-2	-13.4	-10.7	-9.6	-9.3	-9.3	-10.3
-5	-14.7	-10.2	-9.8	-9.4	-9.2	-10.4
-10	-14.2	-9.7	-9.4	-8.8	-8.8	-9.2
-20	-6.2	-6.7	-6.5	-6.8	-6.9	-6.8
-30	-3.0	-3.7	-3.2	-3.7	-3.8	-4.5

AIR	-15.0	-14.4	-12.7	-11.5	-9.9	-11.1
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STEAMBOAT SPRINGS, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 1

DATE: 1/13/80

TIME OF DAY (HOURS)

	1000	1130	1330	1410	1520	1550
L	1	1	1	1	1	1
100						
50	-2.4	-0.9	0.7	1.5	-0.4	-0.0
0	-0.8	1.0	1.7	2.0	-0.2	1.2
-2	-0.9	1.3	3.4	1.9	-0.6	1.3
-5	-0.3	1.6	0.8	2.7	-0.1	1.7

DEPTH

AGL(cm)

0	-1.5	0.4	1.7	1.7	0.1	0.6
-2	-1.5	0.4	1.4	1.7	0.1	0.8
-5	-1.4	0.6	1.4	1.7	0.0	0.8
-10	-1.6	-0.1	1.4	1.7	-0.1	0.7
-20	-2.4	-0.9	0.9	1.4	-0.6	-0.5
-30	-2.9	-1.5	0.6	1.6	-0.9	-0.4

AIR -1.0 2.6 5.1 3.5 2.0

DATE: 1/15/80

	1045	1230	1400	1500	1650	1730
L	1	1	1	1	1	1

DEPTH

AGL(cm)

100						
50	-1.0	-0.9	-0.7	-0.7	-0.7	-0.8
0	-1.0	-0.9	-0.8	-0.7	0.2	-0.4
-2	-0.6	-0.3	0.1	1.2	0.2	1.0
-5	-0.3	-0.3	1.0	0.6	0.3	1.1
-10	-0.7	-0.3	-0.5	-0.5	-4.6	-4.5
-20	-0.9	-0.9	-0.1	-0.6	-1.3	-1.0
-30	-0.9	-1.0	-0.7	-0.7	-0.9	-0.8

DEPTH

BSS(cm)

0	-1.0	-0.9	-0.7	-0.7	-0.7	-0.8
-2	-0.9	-1.0	-0.8	-0.8	-0.8	-0.7
-5	-0.9	-0.9	-0.8	-0.7	-0.8	-0.7

AIR -0.5 -0.3 1.8 1.8 -4.1 -3.1

STEAMBOAT SPRINGS, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 1

DATE: 1/16/80

TIME OF DAY (HOURS)

	1020	1225	1405	1555
L	1	1	1	1

DEPTH

AGL (cm)

100

50	-4.1	-1.2	0.9	-0.2
0	-0.6	-0.0	1.2	0.2
-2	-0.3	1.4	1.5	0.3
-5	0.1	1.7	1.7	0.6

DEPTH

BSS (cm)

0	-2.9	1.6	1.2	-0.2
-2	-3.8	1.6	1.2	-0.3
-5	-4.1	1.2	1.3	-0.2
-10	-4.3	-1.2	0.9	-0.2
-20	-3.3	-1.4	-0.8	-0.2
-30	-2.6	-0.9	-0.6	-0.2

AIR -3.5 -1.0 0.6 -1.4

DATE: 1/18/80

	1104	1405	1510	1600
L	1	1	1	1

DEPTH

AGL (cm)

100

50	-3.2	-1.0	-0.6	-1.1
0	-0.6	-0.6	-0.5	-0.8
-2	-0.3	-0.1	-0.1	-0.2
-5	-0.2	-0.1	0.4	-0.1

DEPTH

BSS (cm)

0	-0.6	-0.4	-0.6	-1.2
-2	-1.6	-0.6	-0.6	-1.2
-5	-2.4	-0.8	-0.6	-0.9
-10	-3.4	-1.0	-1.0	-1.2
-20	-3.4	-2.1	-1.6	-1.6
-30	-2.7	-1.7	-1.8	-1.5

AIR 2.6 5.8 4.9 0.9

STEAMBOAT SPRINGS, COLORADO
 SNOW TEMPERATURE PROFILE
 TEST SITE # 1

DATE: 1/19/80

TIME OF DAY (HOURS)

	920	1052	1305	1420
L	1	1	1	1

DEPTH

AGL (cm)

100

50	-11.1	-8.8	-1.8	-4.1
0	-0.9	-2.9	-0.6	-0.4
-2	-0.4	-0.1	0.9	0.0
-5	-0.1	0.2	1.1	-0.2

DEPTH

BSS (cm)

0	-9.0	-9.2	-3.2	-6.9
-2	-10.6	-8.8	-1.2	-4.4
-5	-11.1	-8.8	-1.8	-3.0
-10	-8.7	-8.4	-4.0	-4.1
-20	-6.1	-6.7	-4.7	-3.8
-30	-3.8	-4.5	-3.6	-2.5

AIR	-8.7	-9.0		-6.8
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STEAMBOAT SPRINGS, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 3

DATE: 1/21/80

TIME OF DAY (HOURS)

1600 1750
L 3 3

DEPTH

AGL (cm)

100	-7.2	-7.4
50	-3.7	-6.1
0	-1.9	-3.2
-2	-0.6	-0.4
-5	-0.3	0.0

DEPTH

BSS (cm)

0	-8.5	-10.3
-2	-8.6	-10.0
-5	-8.1	-9.7
-10	-7.2	-8.7
-20	-7.0	-7.4
-30	-6.2	-6.6

AIR -11.1-11.0

STEAMBOAT SPRINGS, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 1

DATE: 1/22/80

TIME OF DAY (HOURS)

1100 1510
L 1 1

DEPTH
AGL(cm)
100
50 -9.0 -8.6
0 -1.7 -0.9
-2 0.3 -0.1
-5 0.8 0.4

DEPTH
BSS(cm)
0 -16.9 -9.1
-2 -9.0 -8.6
-5 -10.9 -7.9
-10 -9.4 -7.7
-20 -7.3 -6.5
-30 -5.1 -4.9

AIR -17.2-14.0

DATE: 1/24/80
1100 1300
L 1 1

DEPTH
AGL(cm)
100
50 -13.4-10.4
0 -1.1 -1.4
-2
-5

DEPTH
BSS(cm)
0 -9.9 -7.4
-2 -9.9 -7.4
-5 -13.4-10.4
-10 -14.5-11.8
-20 -14.5-12.7
-30 -12.2-10.5

AIR -9.1 -8.0

STEAMBOAT SPRINGS, COLORADO
 SNOW TEMPERATURE PROFILE
 TEST SITE # 2

DATE: 1/25/80

TIME OF DAY (HOURS)

	1110	1325	1540
L	1	1	1

DEPTH

AGL (cm)

100

50	-6.7	-6.9	-5.9
0	0.2	0.3	-0.9
-2	0.8	1.9	0.3
-5	-0.3	2.5	0.5

DEPTH

BSS (cm)

0	-3.0	-3.4	-4.7
-2	-3.0	-3.4	-4.7
-5	-5.0	-4.2	-5.3
-10	-5.8	-5.3	-5.5
-20	-7.0	-6.9	-6.2
-30	-6.0	-6.5	-6.2

AIR	-2.3	-1.0	-4.9
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STEAMBOAT SPRINGS, COLORADO
 SNOW TEMPERATURE PROFILE
 TEST SITE # 1

DATE: 1/26/80

TIME OF DAY (HOURS)

	1100	1130	1430
L	1	1	1

DEPTH

AGL(cm)

100

50 -6.0 -6.2 -8.7

0 -0.1 0.8 -3.3

-2

-5

DEPTH

BSS(cm)

0 -5.7 -5.1 -5.9

-2 -5.5 -4.6 -7.0

-5 -5.7 -4.9 -7.9

-10 -6.4 -5.8 -8.4

-20 -6.0 -6.0 -7.7

-30 -4.9 -5.1 -6.8

AIR -9.3 -6.4-11.9

DATE: 1/29/80

1115

L 1

DEPTH

AGL(cm)

100

50 -3.5

0 0.3

-2

-5

DEPTH

BSS(cm)

0 -1.7

-2 -2.3

-5 -3.0

-10 -4.0

-20 -4.7

-30 -4.2

AIR -4.0

STEAMBOAT SPRINGS, COLORADO
 SNOW TEMPERATURE PROFILE
 TEST SITE # 2

DATE: 1/30/80
 1000 1145 1315
 L 1 1 1

DEPTH
 AGL(cm)
 100 -19.3-15.5-10.9
 50 -3.3 -3.4 -3.2
 0 -0.5 -0.4 -0.4
 -2
 -5

DEPTH
 BSS(cm)
 0 -23.0-18.5-18.9
 -2 -22.0-16.0 -8.0
 -5 -19.3-15.5-10.9
 -10 -16.0-12.5-11.4
 -20 -9.5 -7.4 -7.0
 -30 -8.5 -5.5 -6.5

AIR -22.0-17.0-15.4

STEAMBOAT SPRINGS, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 1

DATE: 1/30/80

TIME OF DAY (HOURS)

1445 1600
L 1 1

DEPTH

AGL(cm)

100

50 -8.5 -3.0

0 -1.2 -0.9

-2

-5

DEPTH

BSS(cm)

0 -9.5-11.0

-2 -9.4-11.3

-5 -9.4-10.0

-10 -9.4 -7.8

-20 -9.0 -6.0

-30 -8.5 -3.9

AIR -10.5-15.0

DATE: 1/31/80

1530 1720
L 1 1

DEPTH

AGL(cm)

100

50 -7.5

0 -0.5

-2

-5

DEPTH

BSS(cm)

0 -14.5-14.5

-2 -12.2

-5 -11.5

-10 -10.5

-20 -10.0

-30 -7.5

AIR -13.6

STEAMBOAT SPRINGS, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 1

DATE: 2/ 1/80

TIME OF DAY (HOURS)

	1100	1200	1215	1300	1445
L	1	1	1	1	1

DEPTH

AGL(cm)

100

50	-3.7		-4.7		-3.7
0	0.5		-0.0		-0.0
-2					0.6
-5					0.8

DEPTH

BSS(cm)

0	-5.7	-0.5	-1.5	0.5	-0.1
-2	-3.0	-2.0	-1.6	-1.0	-1.1
-5	-5.0		-0.7	-2.5	-2.4
-10	-6.0		-6.8	-3.5	-5.0
-20	-5.5		-5.8	-5.0	-5.0
-30	-3.5		-3.8		-3.7

AIR -6.25 -3.0 0.5 -2.0

DATE: 2/ 4/80

	1330	1400	1430	1500	1540	1610
L	1	1	1	1	1	1

DEPTH

AGL(cm)

100

50	-1.7	-1.7	-1.7	-1.5	-1.5	-1.5
0	-0.1	-0.1	-0.0	-0.0	-0.0	-0.3
-2	0.6	0.7	0.7	0.5	0.6	0.7
-5	0.8	0.9	0.9	0.7	0.8	0.9

DEPTH

BSS(cm)

0	-0.0	-0.0	-0.8	-0.0	-1.2	-3.7
-2	-0.1	0.1	-1.0	-0.1	-0.8	-3.4
-5	-0.3	-0.2	-0.5	-0.2	-0.7	-1.1
-10	-1.0	-0.9	-0.9	-0.6	-1.0	-1.0
-20	-1.7	-1.6	-1.6	-1.3	-1.4	-1.4
-30	-1.7	-1.7	-1.7	-1.6	-1.7	-1.7

AIR -0.0 1.0 0.6 1.0 0.6 0.1

STEAMBOAT SPRINGS, COLORADO
 SNOW TEMPERATURE PROFILE
 TEST SITE # 2

DATE: 2/ 7/80

TIME OF DAY (HOURS)

1330 1450
 L 1 1

DEPTH

AGL (cm)

100
 50 -3.8 -2.6
 0 -0.8 -0.0
 -2 0.6
 -5 0.9

DEPTH

BSS (cm)

0 -3.0 -2.5
 -2 -2.5 -2.2
 -5 -1.7 -2.2
 -10 -1.7 -2.9
 -20 -1.9 -3.6
 -30 -3.6 -3.3

AIR -2.1

DATE: 2/ 9/80

1535 1632
 L 1 1

DEPTH

AGL (cm)

100
 50 -4.5 -5.0
 0 -0.6 -0.0
 -2 0.4 0.6
 -5 1.1 1.0

DEPTH

BSS (cm)

0 -10.3-17.8
 -2 -11.9-16.7
 -5 -11.8-13.5
 -10 -12.2-12.6
 -20 -12.8-11.2
 -30 -12.5-10.4

AIR -10.5-13.8

STEAMBOAT SPRINGS, COLORADO
 SNOW TEMPERATURE PROFILE
 TEST SITE # 1

DATE: 2/10/80

TIME OF DAY (HOURS)

1235 1625
 L 1 1

DEPTH
 AGL(cm)

100
 50 -13.6-10.3
 0 -0.3 -0.0
 -2 0.5 0.5
 -5 0.8 0.8

DEPTH
 BSS(cm)

0 -10.6-11.1
 -2 -11.1-10.6
 -5 -11.7-10.8
 -10 -14.6-11.0
 -20 -12.4-10.0
 -30 -9.3 -8.7

AIR -9.7

STEAMBOAT SPRINGS, COLORADO
SNOW TEMPERATURE PROFILE
TEST SITE # 3

DATE: 2/11/80

TIME OF DAY (HOURS)

1335
L 3

DEPTH
AGL(cm)
100 -13.0
50 -5.3
0 -0.7
-2 0.3
-5 0.5

DEPTH
BES(cm)
0 -3.1
-2 -10.1
-5 -10.6
-10 -13.0
-20 -12.7
-30 -10.3

AIR -7.4

STEAMBCAT SPRINGS, COLORADO
 SNOW TEMPERATURE PROFILE
 TEST SITE # 1

DATE: 2/23/80

TIME OF DAY (HOURS)

	1000	1300	1415	1625
L	1	1	1	1

DEPTH
 AGL (cm)

100				
50	0.1	0.1	0.1	0.1
0	0.1	0.2	0.1	0.1
-2	0.5	0.5	0.4	0.5
-5	0.6	0.6	0.5	0.7

DEPTH
 BSS (cm)

0	0.2	0.1	-0.0	-1.8
-2	-0.1	0.2	0.1	-1.5
-5	-0.3	0.1	0.1	-0.6
-10	-0.7	0.1	0.1	-0.3
-20	-0.6	0.1	0.1	-0.3
-30	0.1	-0.0	-0.0	0.1

AIR	2.5	0.7	-1.0	-1.9
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APPENDIX A4

Snow Liquid Water

Liquid water contents are given both in percentage by weight m_w and percentage by volume m_v and are related by snow density:

$$m_v = \rho_s m_w$$

The sample intervals are given in centimeters below snow surface (BSS).

COLORADO 1979-1980
SNOW LIQUID WATER m_v (%)

TIME	CALOR. #	LAYER INTERVAL BSS	SNOW TEMP.	SNOW LIQUID WATER	SNOW DENSITY	SNOW LIQUID WATER
		(cm)	(°C)	m_w (% by wt)	(gm/cm ³)	m_v (% by vol)
DATE: 12/15/79						
1330	1	0- 2	-7.0	0.00	0.13	0.00
1600	1	0- 2	-4.9	3.00	0.13	0.39
DATE: 12/16/79						
0810	1	0- 5	-6.0	11.24	0.11	1.24
0845	1	0- 5	-4.4	5.32	0.11	0.59
0935	1	0- 5	-4.8	4.90	0.11	0.54
1040	1	0- 5	-0.9	14.82	0.11	1.63
1145	1	0- 2	-1.2	0.00	0.11	0.00
1225	1	0- 2	-1.0	3.33	0.11	0.37
1322	1	0- 2	-0.2	0.00	0.13	0.00
1400	1	0- 2	-1.5	2.21	0.13	0.29
1520	1	0- 2	-4.9	3.30	0.13	0.43
1630	1	0- 2	-7.5	1.64	0.13	0.21
DATE: 12/18/79						
1100	1	0- 2	-13.0	1.80	0.20	0.36
1140	1	0- 2	-9.9	3.16	0.20	0.63
1230	1	0- 2	-6.6	4.87	0.18	0.88
1330	1	0- 2	-6.9	8.19	0.18	1.47
1415	1	0- 2	-6.3	2.44	0.18	0.44
1510	1	0- 2	-7.3	0.00	0.18	0.00
DATE: 12/20/79						
1208	1	0- 2	-12.2	7.01	0.18	1.26
1340	1	0- 2	-5.3	3.42	0.18	0.62
1505	1	0- 2	-6.9	2.20	0.18	0.40

COLORADO 1979-1980
SNOW LIQUID WATER m_v (%)

TIME	CALOR. #	LAYER INTERVAL BSS	SNOW TEMP. ($^{\circ}\text{C}$)	SNOW LIQUID WATER m_w (% by wt)	SNOW DENSITY (gm/cm^3)	SNOW LIQUID WATER m_v (% by vol)
DATE: 1/ 5/80						
1130	1	0- 2	-3.2	0.32	0.11	0.04
1330	1	0- 2	-1.1	11.49	0.14	1.61
DATE: 1/ 9/80						
1320	1	0- 2	-1.1	0.00	0.11	0.00
1400	1	0- 2	-0.1	0.00	0.11	0.00
DATE: 1/10/80						
1130	1	0- 2	-0.6	14.69	0.14	2.06
1315	1	0- 2	-0.2	20.28	0.14	2.84
1400	1	0- 2	-0.2	40.15	0.14	5.62
DATE: 1/11/80						
1300	1	0- 2	-10.7	0.00	0.15	0.00
1446	1	0- 2	-9.3	3.77	0.15	0.57
DATE: 1/13/80						
1020	1	0- 2	-1.4	25.77	0.17	4.38
1100	1	5-10	0.0	0.49	0.24	0.12
1100	2	2- 5	0.0	10.95	0.12	1.31
1240	1	0- 2	1.0	16.23	0.21	3.41
1300	2	10-15	1.0	12.46	0.33	4.11
1430	1	0- 2	1.7	34.65	0.21	7.28
1500	1	2- 5	0.3	13.82	0.14	1.94
DATE: 1/14/80						
1130	1	0- 2	0.0	14.24	0.28	3.99
1130	1	2- 5	0.0	12.00	0.13	1.56
1130	1	10-15	0.0	8.94	0.44	3.93
DATE: 1/15/80						
1110	1	0- 2	-0.7	0.89	0.39	0.35
1132	2	2- 5	-0.8	13.14	0.22	2.89
1215	1	0- 5	-0.9	3.38	0.39	1.32
1215	2	5-10	-0.8	15.93	0.39	6.21
1340	1	0- 2	-0.4	9.18	0.37	3.40
1415	2	2- 5	-0.5	6.19	0.25	1.55
1445	1	0- 2	-0.7	6.72	0.37	2.49
1532	1	5-10	-0.7	15.39	0.31	4.77
1615	2	0- 2	-0.8	9.04	0.37	3.35
1700	2	0- 2	-1.2	6.70	0.37	2.48

COLORADO 1979-1980
SNOW LIQUID WATER m_v (%)

TIME	CALOR. #	LAYER INTERVAL BSS	SNOW TEMP.	SNOW LIQUID WATER	SNOW DENSITY	SNOW LIQUID WATER
		(cm)	(°C)	m_w (% by wt)	(gm/cm ³)	m_v (% by vol)
DATE: 1/16/80						
1004	1	0- 2	-4.0	0.00	0.38	0.00
1100	2	0- 2	-1.4	0.00	0.33	0.00
1230	1	2- 5	-1.0	6.21	0.33	2.05
1330	1	0- 2	-0.1	6.99	0.21	1.47
1410	1	0- 2	1.2	7.86	0.18	1.41
1515	2	2- 5	0.2	14.37	0.40	5.75
1605	1	0- 2	-0.2	2.22	0.10	0.22
DATE: 1/18/80						
1000	1	0- 2	-1.0	20.54	0.13	2.67
1148	1	2- 5	-1.0	4.94	0.34	1.68
1300	2	0- 2	-0.7	1.02	0.27	0.28
1340	1	2- 5	-0.6	6.75	0.31	2.09
1455	1	5-10	-0.6	6.15	0.55	3.38
1545	2	0- 2	-1.2	7.03	0.40	2.81
1645	1	2- 5	-1.0	0.00	0.28	0.00
DATE: 1/19/80						
0954	2	0- 2	-8.8	0.72	0.40	0.29
1050	2	0- 2	-9.2	1.57	0.40	0.63
1150	2	0- 2	-5.2	0.00	0.40	0.00
1334	1	0- 2	-1.2	0.00	0.40	0.00
DATE: 1/21/80						
1730	2	0- 2	-10.0	0.02	0.17	0.00
DATE: 1/22/80						
1225	2	0- 2	-9.2	0.00	0.08	0.00
1345	2	0- 2	-6.0	0.00	0.08	0.00
1425	2	0- 2	-8.0	2.68	0.08	0.21
DATE: 1/25/80						
1150	1	0- 2	-5.8	0.00	0.38	0.00
1520	2	0- 2	-4.7	0.00	0.38	0.00

COLORADO 1979-1980
SNOW LIQUID WATER m_v (%)

TIME	CALOR. #	LAYER INTERVAL BSS	SNOW TEMP. (°C)	SNOW LIQUID WATER m_w (% by wt)	SNOW DENSITY (gm/cm ³)	SNOW LIQUID WATER m_v (% by vol)
DATE: 1/26/80						
1455	1	0- 2	-7.0	0.00	0.24	0.00
DATE: 1/29/80						
1430	1	0- 2	0.6	0.00	0.09	0.00
1515	1	0- 2	1.5	0.00	0.09	0.00
DATE: 2/ 1/80						
1330	1	0- 2	-0.9	0.00	0.11	0.00
1415	1	0- 2	0.1	1.07	0.11	0.12
DATE: 2/10/80						
1520	1	0- 2	-10.6	2.69	0.26	0.70
DATE: 2/11/80						
1520	1	0- 2	-9.8	2.07	0.30	0.62
DATE: 2/23/80						
1045	1	0- 2	0.1	3.98	0.16	0.64
1145	1	2- 5	0.2	17.51	0.31	5.43
1215	1	0- 2	0.2	15.57	0.16	2.49
1445	1	0- 2	0.2	0.00	0.16	0.00
1600	1	5-10	-1.2	2.53	0.31	0.80

APPENDIX A5

Snow Surface Roughness

Photographs of the snow surface roughness against a 2.54 cm x 2.54 cm grid are shown when possible. Also shown are overall photographs of the field when grid photographs were not obtained. The table below summarizes the photographs and observations of the surface.

Date	Photograph		Observations
	Grid	Overall	
12/15/79			Smooth surface
12/16/79		Fig.A1	Smooth surface 0900
12/16/79	Fig.A2		Wind-roughened 1700
12/20/79		Fig.2.10a	Slightly rougher than 12/16/79
01/05/80			Smooth surface
01/06/80			High winds, rougher
01/09/80	Fig.2.4	Fig.A3	Smooth surface
01/13/80			Sunken points at approximately 1 m spacing <div> </div>
01/24/80			Smooth surface
01/26/80			Smooth surface
01/27/80			Smooth surface
01/29/80			Very smooth surface
02/01/80	Fig.A4	Fig.A5	
02/10/80	Fig.A7	Fig.A6	Rough surface
02/11/80	Fig.A8	Fig.A9	Rough surface

Date	Photograph		Observations
	Grid	Overall	
02/14/80	Fig.A10		Smooth but rolling surface
02/16/80	Fig.A11		Smooth
02/23/80		Fig.A12	Very smooth surface

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Figure A1. Site #4, smooth surface, 0900 hours, 12/16/79.

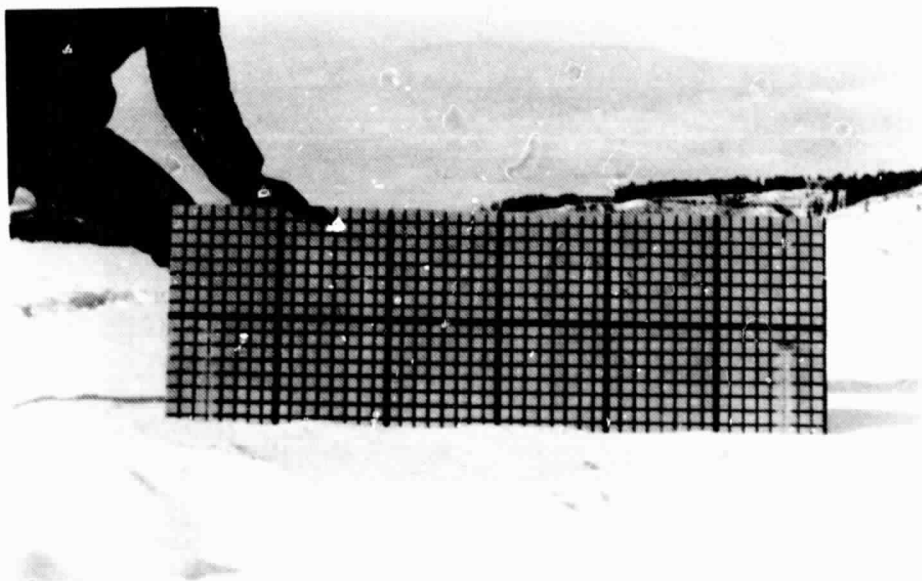


Figure A2. Site #4, wind roughened surface, 1700 hours, 12/16/79.

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Figure A3. Site, #1, smooth surface, 1/9/80.

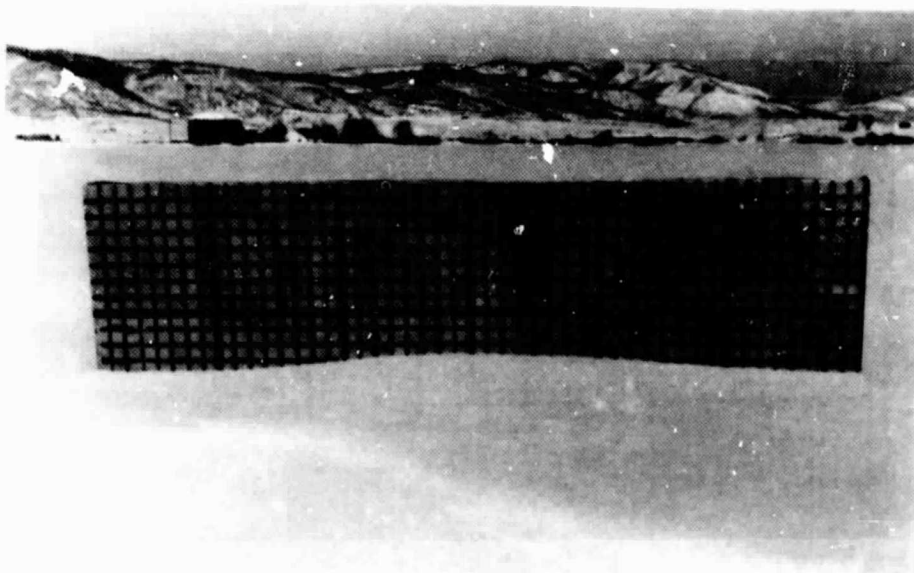


Figure A4. Site #1, wavelike surface, 2/1/80.

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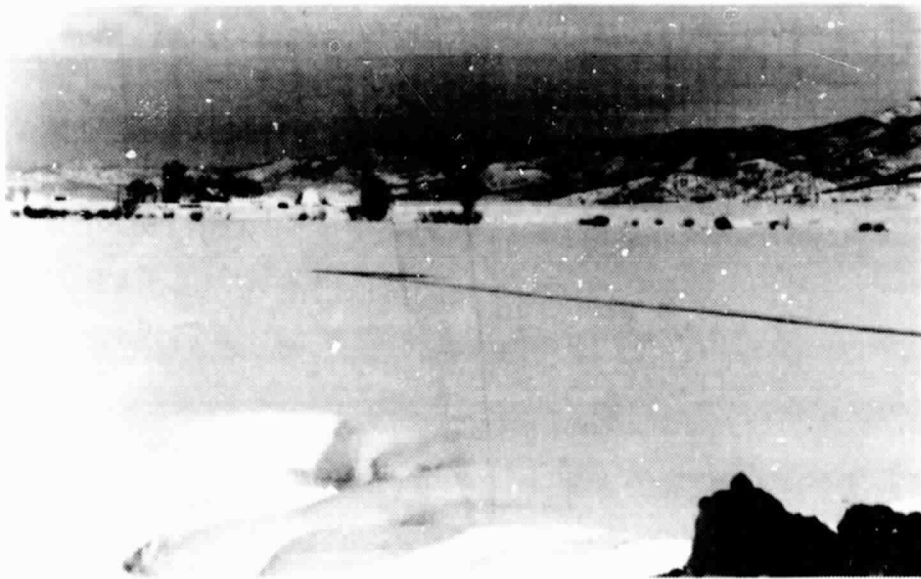


Figure A5. Site #1, wavelike surface, 2/1/80.



Figure A6. Site #1, rough surface, 2/10/80.

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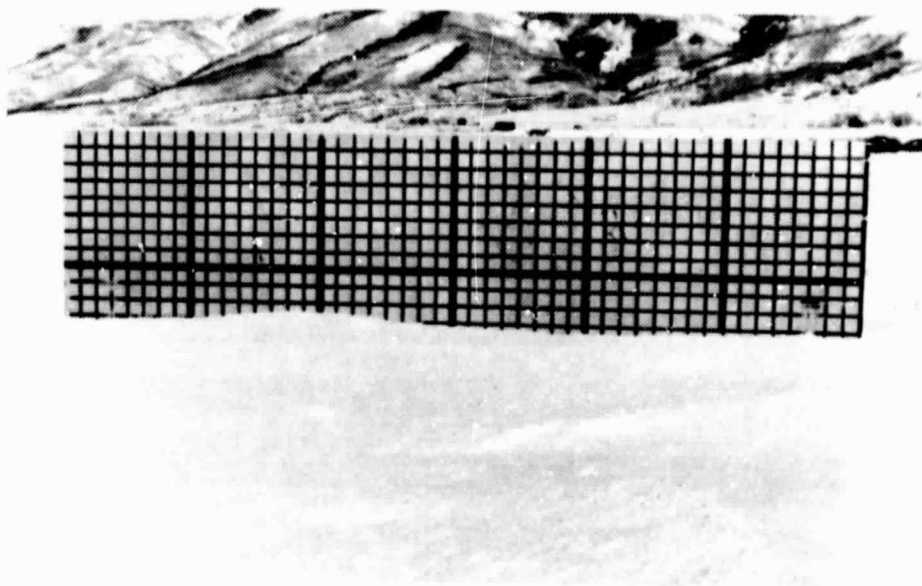


Figure A7. Site #1, rough surface, 2/10/80.

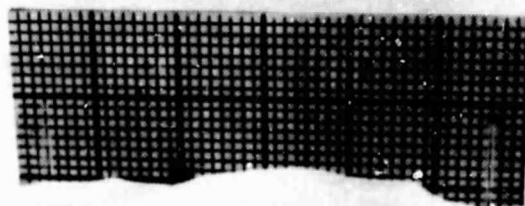


Figure A8. Site #3, rough surface, 2/11/80.

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Figure A9. Site #3, rough surface, 2/11/80.

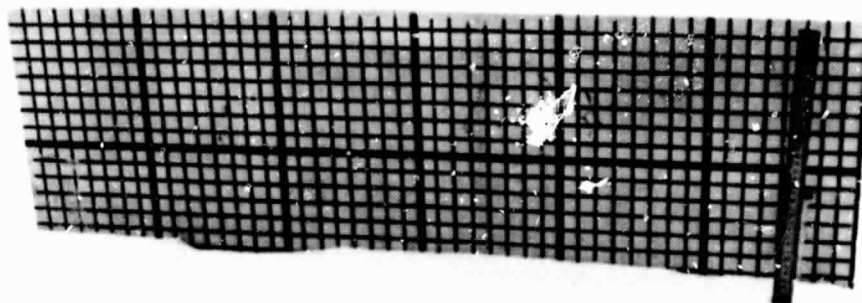


Figure A10. Site #1, rolling surface, 2/14/80.

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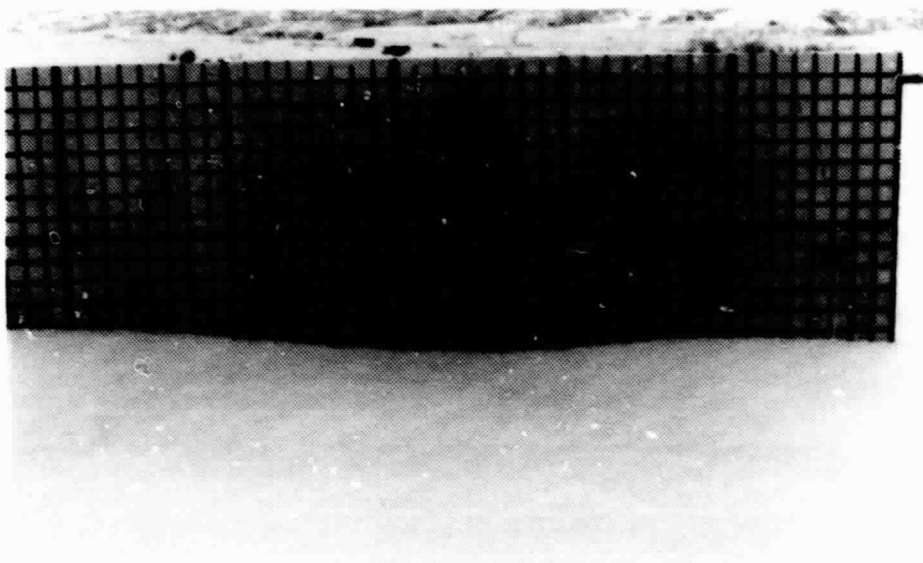


Figure A11. Site #1, 2/16/80.



Figure A12. Site #1, smooth surface, 2/23/80.

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Figure A13. Site #1, bare (trace of snow) ground, 2/25/80.

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APPENDIX A6

Soil Data

Soil temperatures, soil state (F - frozen, T - thawed, or PF - partially frozen), and soil moisture m_{sg} on a percent by dry-weight basis are given. Gravimetric soil moisture was calculated by:

$$m_{sg} = \frac{W_{wet} - W_{dry}}{W_{dry}} \times 100$$

where W_{wet} is the wet weight and W_{dry} is the dry weight.

COLORADO 1979-1980

SITE	DATE	TIME	LOCA	DEPTH (cm)	FROZEN C. THAWED	TEMP (°C)	DRY WEIGHT (gm)	WET WEIGHT (gm)	m _{sg} %
4	12/15/79	1440	1	2-5	T		43.6	51.0	16.9
4	12/15/79	1440	1	0-2	T	-1.7	31.9	40.5	27.0
4	12/16/79	0820	1	0-2	T	*-2.0	34.1	46.1	35.2
4	12/16/79	0820	1	2-5	T		39.8	47.9	20.3
4	12/18/79	1420	1	0-2	T	*-1.6	28.1	36.6	30.2
4	12/18/79	1420	1	2-5	T		33.0	40.9	23.9
4	12/19/79	1830	1	0-2	PF		27.5	34.9	26.9
4	12/19/79	1830	1	2-5	PF		42.3	52.8	24.8
4	12/19/79	1830	**5	0-2	PF		30.3	36.1	19.1
4	12/19/79	1830	**5	2-5	PF		33.5	46.8	39.7
4	12/20/79	1550	1	0-2	F	*-2.4	32.2	42.5	32.0
4	12/20/79	1550	1	2-5	F		41.5	50.2	21.0
1	1/ 5/80	1130	1	0-2		*-4.8	24.6	36.0	46.3
1	1/ 5/80	1130	1	2-5			36.8	52.5	42.7
1	1/ 6/80	1540	1	0-2	T	*-6.0	26.8	39.3	46.6
1	1/ 6/80	1540	1	2-5	T		40.7	53.8	32.1
1	1/ 7/80	1516	1	0-2	T	*-1.1	23.5	35.5	51.0
1	1/ 7/80	1516	1	2-5	T		44.2	57.5	30.1
1	1/ 9/80	1120	1	0-2	T	1.7	26.3	39.5	50.2
1	1/ 9/80	1120	1	2-5	T	2.1	46.8	60.7	29.7
1	1/10/80	1000	1	0-2	T	0.3			
1	1/13/80	1000	1	0-5	T	-0.7			
1	1/15/80	1015	1	0-5	T	-0.6			
1	1/15/80	1445	1	0-5	T	0.1			
1	1/16/80	0950	1	0-5	T	-0.3			
1	1/16/80	1445	1	0-5	T	1.5			
1	1/18/80	1010	1	0-5	T	-0.3			
1	1/18/80	1600	1	0-5	T	-0.2			
3	1/21/80	1445	3	0-5	T	-0.6			
1	1/26/80	1545	1	0-2	T	*-3.3	27.2	43.0	58.1
1	1/26/80	1545	1	2-5	T		44.5	58.7	31.9
2	1/27/80	1300	1	0-5	T				
1	1/29/80	1155	1	0-3	T	* 0.3	52.5	89.2	69.9
1	1/30/80	1500	1	0-5	T	*-1.2			
1	1/31/80	1340	1	0-5	T	*-0.5			

(1) * implies soil surface temperature

(2) ** implies bare ground soil moisture

COLORADO 1979-1980

SITE	DATE	TIME	LOCA	DEPTH (cm)	FROZEN OR THAWED	TEMP (°C)	DRY WEIGHT (gm)	WET WEIGHT (gm)	m ^s g %
1	2/ 1/80	1100	1	0-5	T	* 0.5			
1	2/ 1/80	1500	1	0-5	T				
1	2/ 4/80	1100	1	0-5	T	-0.1			
1	2/ 7/80	1400	1	0-5	F	0.0			
1	2/10/80	1315	1	0-5	T	0.5			
3	2/11/80	1330	1	0-5	T	0.3			
1	2/14/80	1445	1	0-5	T	0.2	43.4	66.1	52.8
1	2/16/80	1430	1	0-5	T	0.2	46.7	71.2	52.4
1	2/23/80	1330	1	0-5	T	0.5			
1	2/25/80	1630	**5	0-5	T	0.1	70.5	94.4	33.9

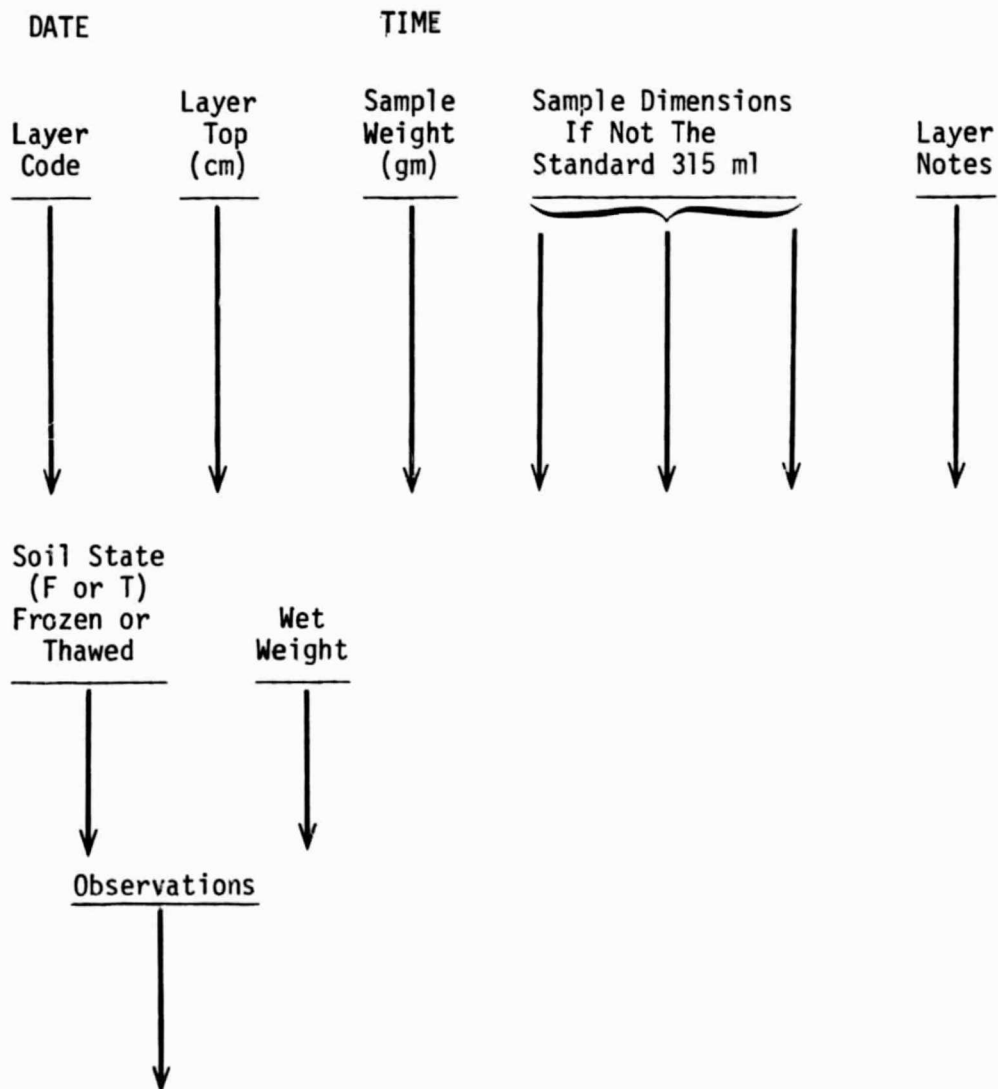
- (1) * implies soil surface temperature
 (2) ** implies bare ground soil moisture

APPENDIX A7

Unprocessed Stratification Data and Field Notes

General observations as noted by the ground-truth personnel are given along with the unprocessed snow stratification data.

The format is shown below:



COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

DATE: 12/15/79 1354 WP

20 49.0 442.6
4 48.0 40.8
3 34.0 160.6
2 28.0 108.2
1 13.0 91.0

*POWDER 0.5 MM
*CRUST 0.5 MM
*POWDER 1.5 MM
*DEPTH HOAR 3.0 MM

T 40.5

T 51.0

OBS: SOIL LOOKED VERY DRY

DATE: 12/16/79 745 WP

20 47.5 382.0
4 47.5 36.6
3 35.0 121.4
2 29.5 78.4
1 10.0 60.6

*DRY POWDER
*HARD CRUST
*DRY POWDER
*DEPTH NEAR

T 46.1

T 47.9

OBS: CLOUDY (FLUFFY CLOUDS 90% COVER) FAIRLY CALM, TEMP= -6C, 0910 = 40% CLOUD COVER.

NOTE: BY 1400 WIND HAD BLOWN SUCH THAT SOME ROUGHNESS WAS APPARENT
SOME AREAS SMOOTH, SOME AREAS HAVE 1 CM RELIEF, GENERALLY
WHOLE PLOT HAS SOME ROUGHNESS DUE TO WIND.

ALSO THERE IS NOW (1400) ABOUT A 1/2 CM CRUST AT THE SURFACE. I
THINK THIS INDICATES AT LEAST SOME MELTING ICE.

PHOTOS WERE TAKEN OF THE ROUGHENED SURFACE(2)

DATE: 12/16/79 1435 WP

20 46.0 438.5
4 46.0 41.5
3 33.5 123.2
2 27.0 76.6
1 7.0 56.5

*WETTER THAN PREVIOUS SAMPLE
*WET- PACK EASY
*VERY FIRM CRUST
*POWDERY
*LARGE CRYSTALS- DRY

T

T

DATE: 12/18/79 930 WP

20 44.0 410.5
5 44.0 63.4 10.0 20.0 0.5
4 43.0 62.9
3 32.0 158.9
2 25.5 100.9
1 13.0 79.0

*CRUST 0.5 MM
*POWDER 0.5 MM
*HARD CRUST 1 MM
*DEPTH HOAR 3 MM CRYSTALS
*DEPTH HOAR, 3.0 MM CRYSTALS

OBS: CLEAR-COLD

DATE: 12/18/79 1335 WP

20 41.5 393.1
5 41.5 61.2 10.0 30.0 0.5
4 41.0 56.3
3 30.0 157.5
2 22.5 90.6
1 6.0 73.8

*1.0 MM
1.0 MM
*1.0 MM
*1.5 MM
*2.0 MM

T 36.6

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

T 40.9

OBS: 16:15 CRUST MEASUREMENT 1.0 CM THICKNESS

DATE: 12/18/79 1830 WP

1 0.0 0.0

*BARE GROUND PARTIALLY FROZEN

PF 34.9

PF 52.8

OBS: TOOK MEASUREMENTS ON THE BARE GROUND & AT LOCATION 1 UNDERNEATH THE SNOW

DATE: 12/20/79 915 WP

20 38.5 381.6

5 38.5 55.0 10.0 30.0 0.5*0.5 MM

4 38.0 57.6 *1.0 MM

3 27.0 135.8 *1.0 MM

2 22.0 84.7 *1.5 MM

1 7.0 73.6 *2.0 MM

F

F

OBS: THIS IS FOR BARE GROUND NO SNOW ON TOP.

DATE: 12/20/79 1545 WP

1 0.0 0.0

*BARE GROUND FROZEN

F 42.5

F 50.2

OBS: FREEZE DEPTH = 15.0 CM

DATE: 1/ 5/80 1030 HIB

20 58.0 434.9

3 58.0 34.7 *1.5 MM

2 30.5 78.1 *2.0 MM

1 10.0 82.7 *2.5 MM

OBS: BROKEN CLOUDS

DATE: 1/ 5/80 1410 HIB

20 58.0 422.1

3 58.0 44.7

2 33.0 88.4

1 10.0 73.3

DATE: 1/ 6/80 1025 HIB

20 54.0 342.7

3 54.0 50.4

*DENSER 0.5 MM

2 39.0 77.3

*1.5 MM

1 9.0 76.5

*2.0 MM

T 39.3

T 53.8

DATE: 1/ 6/80 1530

20 55.0 597.5

4 55.0 58.0

3 48.0 58.5

2 41.0 85.4

1 7.0 74.2

DATE: 1/ 7/80 945 HIB

20 55.5 446.2

5 55.5 21.5

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

4 50.6 62.8
3 37.5 85.6
2 31.0 85.4
1 6.5 76.9

OBS: CONS. SNOW, THERE IS A NON-ABRUPT CRYSTAL SIZE TRANSITION BETWEEN LAYERS 3&4
DATE: 1/ 7/80 1500 HIB

20 57.0 428.0

5 57.0 13.1

*0.5 MM POWDER

4 52.0 43.8

*0.5 MM

3 45.5 64.9

*0.5 MM

2 35.5 81.9

*1.0 MM

1 5.5 89.5

*1.5 MM

T 35.5

T 57.5

DATE: 1/ 9/80 1145 HIB

20 68.0 532.7

4 68.0 36.1

3 46.0 75.4

2 28.5 90.7

1 5.0 96.4

T 39.5

T 60.7

DATE: 1/10/80 1000 HIB

20 60.5 511.7

3 60.5 45.6

*NO ABRUPT TRANSITION BETWEEN 2&3

2 46.0 81.5

*DEPTH HOAR HAS COMBINED

1 35.0 95.5

*WITH NEXT LAYER UP SINCE YESTERDAY

T

T

OBS: WINDY

DATE: 1/11/80 1300 HIB

20 64.0 534.3

4 64.0 49.3

*OLD SNOW, NEW SNOW MIXED

3 56.0 70.1

2 34.0 87.9

1 2.5 69.9 20.0 10.0 2.5*DEPTH HOAR FORMING

DATE: 1/13/80 1000 HIB

20 72.0 609.9

5 72.0 56.0

*SURFACE CRYSTALS UP TO 2.0 MM DIAGONAL

4 65.0 38.5

*1.0 MM CRYSTALS

3 57.0 76.6

*1.0 MM CRYSTALS

2 48.0 81.9

*2.0 MM CRYSTALS

1 32.0 91.5

*3.0 MM CRYSTALS

T

T

OBS: ABOVE FREEZING, TOP THREE LAYERS ARE WET, TOP CENTIMETER IS SATURATED,
DEPTH HOAR HAS COMBINED WITH ABOVE LAYER

DATE: 1/13/80 1410 HIB

20 70.0 520.7

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

5	70.0	67.9				*TOP 2 CM IS SATURATED
4	64.0	46.0				
3	56.0	104.2				*LAYER 3 IS SATURATED
2	51.0	78.4				
1	39.0	88.7				
DATE: 1/14/80 1100 HIB						
20	62.5	613.7				
6	62.5	90.5				*TOP LAYER IS SATURATED
5	58.5	42.8				
4	51.5	141.2				*COMPLETELY SATURATED
3	46.0	93.6				
2	38.0	96.8				
1	30.0	88.1				
DATE: 1/15/80 1015 HIB						
20	58.5	598.2				
5	58.5	125.0				*LARGE CRYSTALS WITH 1.0 CM POWDER ON TOP
4	53.0	70.9				*BASE IS SATURATED
3	42.5	123.7	20.0	10.0	1.0	*CRYSTALLINE SATURATION REGION FROM PREVIOUS DAY
2	41.5	104.6				*INCL. ANOTHER CRYST. SAT. REGION PREV. DAY
1	26.0	85.7				*GRADE CRYSTALLINE SIZE TRANSITION TO TOP OF LAYER
T						
T						
OBS: COLD, FROZEN, AND WET DAY OVERCAST						
DATE: 1/15/80 1445 HIB						
20	56.5	640.0				
6	56.5	116.9				*2.0 MM
5	49.5	79.2				*0.5 MM
4	45.5	99.3	20.0	10.0	1.0	*1.5 MM
3	41.5	103.3				*BASE OF LAYER 3 IS SATURATED, 0.5 MM
2	33.5	104.0				*1.0 MM
1	27.0	91.3				*2.0 MM
T						
T						
OBS: BROKEN OVERCAST, WARMING, SNOW COMPRESSING						
DATE: 1/16/80 950 HIB						
20	58.5	599.6				
7	58.5	41.9				
6	56.0	125.3				
5	50.0	78.2				
4	46.0	208.7	20.0	10.0	3.0	*LARGE CRYSTAL FROZEN
3	42.0	96.7				
2	34.5	100.2				
1	28.5	116.7				
T						
T						
OBS: OVERCAST, FROZEN						
DATE: 1/16/80 1445 HIB						
20	57.5	659.1				
7	57.5	33.6	20.0	10.0	2.5	*5.0 MM-FLAKES

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

6	55.0	126.2				*2.0 MM
5	49.5	93.0				*1.0 MM
4	45.5	151.4	10.0	15.0	2.0*	1.5 MM
3	41.5	99.8				*0.5 MM
2	37.0	104.8				*1.0 MM
1	30.5	88.3				*2.0 MM
T						
T						
DATE: 1/18/80 1010 HIB						
20	56.5	617.7				
7	56.5	42.8	15.0	15.0	2.0*	NEW POWDER
6	54.5	113.0				*FROZEN LARGE CRYSTAL
5	48.0	81.4				
4	43.5	170.2	15.0	10.0	2.0*	FROZEN LARGE CRYSTAL WAS A SATURATED LAYER
3	40.0	100.0				
2	33.0	105.6				
1	27.0	98.3				*DEPTH HOAR
T						
T						
OBS: COLD, WINDY						
DATE: 1/18/80 1600 HIB						
20	53.5	610.6				
6	53.5	128.7				*1.5 MM
5	47.5	88.6				*0.5 MM
4	43.5	196.1	20.0	10.0	2.0*	1.5 MM
3	37.5	101.2				*0.5 MM
2	33.5	105.0				*0.5 MM, HIGH DENSITY
1	28.0	95.8				*2.0 MM
T						
T						
OBS: MELTING, PARTLY CLOUDY						
DATE: 1/19/80 818 HIB						
20	53.5	611.9				
7	53.5	127.9				*LOOSE CRYSTALS LAYER CRYSTALS
6	47.5	85.8				*MODERATELY DAUSE
5	42.5	161.3	10.0	15.0	2.0*	ICY CRYSTALLINE LAYER, VERY HARD
4	39.5	102.4				*DAUSE
3	34.0	100.6	10.0	15.0	1.0*	ICY CRYSTALLINE LAYER, VERY HARD
2	32.0	110.9				*DAUSE SMALL CRYSTALS
1	26.5	87.2				*DEPTH HOAR
DATE: 1/21/80 1445 REP						
20	104.0	1207.6				
6	104.0	53.6				*0.5-1 MM
5	90.0	99.6				*1.0 MM
4	84.0	151.6	15.0	15.0	3.0*	2.0-3 MM ROUND BALLS
3	82.0	89.9				*0.25-1 MM, LESS DENSE
2	74.0	123.8				*0.25-1 MM, VERY DENSE
1	61.0	117.4				*1.5-2.0 MM, 3.0-4 DEPTH HOAR
T						

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

T

OBS: CLOUDY WITH 1/2 MILE VISIBILITY. MODERATE SO HEAVY SNOW. HIGHT FREEZE.
SNOW CRYSTALS 2 MM TO 5 MM IN DIA. DENDRIDIC TYPE MOSTLY

DATE: 1/22/80 1130 HIB

20	54.0	586.1			
7	54.0	27.3	10.0	10.0	3.5
6	50.0	118.2			
5	44.5	84.3			
4	39.5	81.4	10.0	10.0	2.2*ICE
3	37.0	101.3			
2	31.0	88.2	10.0	10.0	2.4*ICE
1	29.5	100.7			

OBS: CLEAR SUNNY AND COLD. NO WIND

DATE: 1/24/80 1145 HIB

20	52.0	651.4			
8	52.0	62.9	15.0	15.0	3.0*SNOW
7	48.0	147.7	10.0	10.0	5.0*ICE
6	42.5	90.0			*SNOW
5	38.5	111.2	10.0	10.0	2.5*ICE
4	36.0	107.0	10.0	15.0	3.0*SNOW
3	32.5	180.8	10.0	15.0	2.5*ICE
2	29.0	111.3			*SNOWY
1	24.0	89.5			*DEPTH HOAR

OBS: CLEAR AND SUNNY AND NO WIND

DATE: 1/25/80 1150 BIL

8	71.0	70.9	10.0	10.0	10.0*FRESH NEW SNOW
7	60.0	120.9			*CRUST 2.0 MM
6	51.0	153.2	10.0	10.0	4.0*ICE
5	46.0	99.0			*LESS THAN 1.0 MM SNOW
4	38.0	65.9	9.0	8.0	2.0*ICE
3	36.0	114.2			*1.5-2 MM DEPTH HOAR
2	26.0	165.2	8.5	8.5	5.0*1.0 MM ICE
1	20.0	113.9			*2.0-3 MM DEPTH HOAR FROZEN IN SPOTS

OBS: SNOWING HARD WIND PICKED UP AT ABOUT 1545 HOURS,

74.5 CM SNOW AT 1630

73.0 CM SNOW AT 1540

DATE: 1/26/80 1225 HIB

20	58.0	585.1			
9	58.0	76.2	10.0	10.0	8.5*LOW SNOW
8	51.0	89.9	9.0	9.5	4.0*HARD CRUST, 1.0-2 MM
7	45.0	85.0			*SNOW 1.0 MM
6	41.0	62.6	8.7	10.5	1.8*ICE
5	39.0	105.6			*SNOW 1.0 MM
4	34.0	68.8	8.5	9.5	3.0*SNOW/ICE 1.0-2 MM
3	32.0	46.0	9.0	9.0	1.2*ICE
2	31.0	110.2			*SNOW 1.0-2 MM
1	25.0	93.1			*DEPTH HOAR 2.0-4 MM

T 43.0

T 58.7

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

OBS: FRESH SNOW 7.0 MM, CLEAR ABOUT 1000-1300, STARTED TO SNOW & SNOWING HARD.
10 CM ABOVE 51 CM LAYER AT 1600 HOURS. SOME SNOW PELLETS ABOUT 1 MM DIA. &
SOME DENDRIDIC CRYSTALS (FRESH SNOW LAYER)

DATE: 1/27/80 1208 BLL

20	82.0	825.3			
10	82.0	30.7	10.0	10.0	5.0*FRESH SNOW 4.0 MM XTALS
9	61.0	76.5	10.0	10.0	5.5*SNOW OF 1/25 4.0 MM XTALS
8	56.0	116.4	10.0	10.0	3.5*RAINED CRUST, 2.0 MM XTALS
7	43.0	107.6			*4.0 MM XTALS
6	35.5	83.5	10.0	10.0	1.5*ICE CRUST
5	34.0	131.0			*1.0 MM XTALS
4	29.5				*ICE CRUST
3	28.5	110.7			*1.0-1.5 MM XTALS
2	22.0				*ICE-CRUST
1	21.0	87.6			*2.0-4 MM XTALS

T 111.2

T

OBS: CLOUDY, CALM, 21 CM NEW SNOW SINCE LAST DAY HERE, ONE OVERALL SOIL SAMPLE

DATE: 1/29/80 1155 HIB

20	89.5	794.9			
10	89.5	30.1	10.0	10.0	5.0*FRESH SNOW
9	77.0	45.9			*SNOW
9	56.5	59.9			
8	51.0	127.2			*COLD CRUST
7	40.5	102.9	10.0	10.0	3.0*CRUST
6	38.0	90.4	10.0	10.0	3.0*SNOW
5	35.0	142.8			*ICE CRUST
4	34.0	142.8			*SNOW
3	32.0	142.8			*ICE CRUST
2	31.0	109.1			*OLD DEPTH HOAR, METAMORPHISED TO OLD SNOW
1	16.0	88.1			*DEPTH HOAR

T 89.2

T

OBS: CLOUDY & LIGHT SNOW, TEMP ABOUT -1 C TO -3 C

DATE: 1/30/80 900 BLL

20	106.0	1016.6			
11	107.0	58.4			*FRESH SNOW
10	102.0	49.9			*LOOSE SNOW
9	70.0	63.6			*COMPACTED SNOW
8	56.5	138.3			*RAINED ON SNOW LAYER
7	44.0	107.3			
6	36.0	117.9	10.0	10.0	2.0*ICE CRUST
5	34.0	175.4	10.0	15.0	3.0
4	29.5	175.4			*ICE CRUST
3	29.0	105.7			*LOOSE, LARGE XTALS DIRTY SNOW LAYER AT BOTTOM
2	25.0	155.0			*DENSE LAYER
1	19.0	117.8			*HOAR

OBS: CLEAR, CALM, 5.0 CM OF NEW SNOW OVERNIGHT (25 CM SINCE LAST OBSERVATION)

DATE: 1/30/80 1500 HIB

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

20	86.0	814.5				
10	86.0	21.0	10.0	15.0	1.0	*THIS MORNING SNOW
9	85.5	62.2				*LAST NIGHT SNOW
8	79.5	52.2				
7	58.0	67.6				
6	50.0	128.5				*RAINED-ON SNOW CRUST
5	40.0					*HARD ICE CRUST
4	38.0					
3	32.0					*HARD ICE CRUST
2	30.0					
1	25.0					*DEPTH HOAR

T

T

OBS: CLEAR & CALM

DATE: 1/31/80 1340 HIB

20	81.0	841.0				
15	81.0	18.0	10.0	10.0	1.5	*MOST RECENT, SNOW
14	80.5	57.9				*FRESH SNOW (NIG. OF 1/29/80_1/30)
13	76.0	37.8	10.0	10.0	3.0	*FRESH-POWDER IN LITTLE BALLS
12	73.0	59.8				*FRESH
11	66.5	55.0				*FRESH
10	56.0	72.8				*DENSEST FRESH SNOW
9	48.0	121.8				*RAIN ON ICE
8	42.0					
7	37.0					*ICE
6	33.0					
5	28.0					*ICE
4	27.0					*GRANULAR XTLS LESS THAN 1.0 MM
3	22.5					*ICE
2	22.0					*MORE DENSE, DEPTH HOAR
1	17.0					*DEPTH HOAR

T

T

OBS: PARTLY CLEA, PARTLY CLOUDY (THE PART THAT'S CLOUDY HAS CIRRUS CLOUD)
SUNNY AND COLD

DATE: 2/ 1/80 1100 HIB

20	77.7					*UNCONSOLIDATED SNOW XTALS
10	76.5					*THIN, WEAK CRUST
9	75.5					*LESS DENSE FRESH SNOW
8	57.0					*PACKED FRESH SNOW
7	49.0					*RAINED-ON CRUST
6	42.0					
5	38.0					*ICE CRUST
4	35.0					
3	29.0					*ICE CRUST
2	27.5					*LARGE XTALS, DENSER THAN HOAR
1	22.0					*DEPTH HOAR

T

T

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

OBS:PARTLY SUNNY, INCREASING CLOUDINESS TO WEST & NORTH, CALM ALL SURFACE W/
SONTHERLY WINDS ALOFT. NO EVIDENCE OF PREDATORS.

DATE: 2/ 1/80 1500 HIB

20	78.5	807.3			
10	78.5	35.4	30.0	10.0	1.0*SLIGHTLY MELTED + REFOZE FRESH
9	73.0	61.8			*FRESH-LESS DENSE
8	55.0	85.4			*FRESH-MORE DENSE
7	49.0	128.7			*RAINED ON ICE
6	43.0				
5	39.0				*ICE
4	36.0				
3	29.0				*ICE
2	27.5				*LESS COURSE DEPTH HOAR
1	22.0				*DEPTH HOAR

T

T

OBS:CLOUDY, CALM, AIRCRAFT OVERHEAD, COOLING

DATE: 2/ 4/80 1300 HIB

20	74.0	800.3			
7	74.0	69.4			*FRESH POWDER
6	68.0	79.7			*SNOW
5	46.5	128.2			*SNOW/ICE
4	40.5	101.4			*SNOW
3	36.0	228.6	10.0	20.0	2.0*ICE LAYER
2	25.5	131.3			
1	14.0	107.4			

T

T

OBS:WARMING, OVERCAST

DATE: 2/ 7/80 1460 BLL

20	96.5	1127.5			
11	96.5	69.9			*1.0 MM CRYSTALIZED SNOW
10	56.0	122.5			*1.5 MM CRYSTALIZED SNOW
9	47.5	149.5			*1.0 MM ICE
8	42.0	117.5			*1.0 MM SNOW
7	35.0				*INTERMEDIATE ICE AND CRYSTALINE IAYERS
6	33.0				*INTERMEDIATE ICE AND CRYSTALINE LAYERS
5	30.5				* SAME AS 6
4	28.0				* SAME AS 6
3	25.5				* SAME AS 6
2	23.5				*SAME AS 6
1	20.0				*DAPTH HOAR

F

F

OBS:PARTLY CLOUDY WITH WIND

DATE: 2/ 9/80 1452 BLL

20	96.5	1210.2			
11	96.5	89.0			*GRADUAL DENSITY INCREASE WITH DEPTH
10	53.5	73.8			

COLORADO, 1979-1980
SNOW STRATIFICATION, DENSITY
AND WATER EQUIVALENT

9	55.0	128.4			
8	47.5	323.2	10.0	20.0	3.0*ICE LAYER
7	41.0	115.3			
6	36.0	227.4	10.0	20.0	2.0*ICE LAYER
5	33.0	128.4			
4	28.5				
3	27.5				
2	22.0				
1	20.0				

OBS: CLEAR, COLD, STILL

DATE: 2/10/80 1315 HIB

20	65.5	765.9			
8	65.5				*CRUST
7	65.0				*0.5-1 MM
6	48.0	83.1			*0.5-1 MM
5	40.5	104.1			*1.0 MM
4	35.5	101.4			*1.0 MM
3	33.5	109.9	2.5	11.0	10.0*ICE 1.0-7 MM
2	24.0	129.5			*1.0-1.5 MM
1	15.0	98.0			*2.0 MM TOP, 2.0-4 MM OVERALL

T

T

OBS: CLEAR, SUNNY & VERY COLD LAST NIGHT, SOME SNOW MAY HAVE BLOWN AWAY SINCE
LAST MEASUREMENT? I DONT'T THINK IT MELTED AWAY.

DATE: 2/11/80 1330 REP

20	111.0	1536.4			
9	111.0	95.2			
8	90.0	102.8	10.0	9.0	3.0
7	87.0	115.6			
6	79.5	121.6			
5	74.0	145.8			
4	68.0	125.2			
3	62.0	129.5			
2	49.0	115.4			
1	40.0	128.0			

T

T

DATE: 2/23/80 1330 HIB

20	83.5	984.7			
9	83.5	50.3	8.0	7.5	7.5*FRESH SNOW
8	70.0	97.4	8.0	8.0	6.5*HARD CRUST
7	61.0	115.2	8.0	8.0	5.5
6	55.0	109.4			
5	39.0	128.8			
4	31.5	80.0	9.0	10.0	2.2*ICE LAYER
3	29.0	151.5			
2	24.0	48.6	8.5	9.0	1.5*ICE LAYER
1	22.0	114.5			

T

APPENDIX B

Radar Data

The columns correspond to σ^0 (dB) for each of the seven frequencies shown. For each angle three polarizations HH, HV, and VV could be measured. Blanks indicate either bad data or that the data was not taken at that frequency, angle or polarization configuration.

WINTER PARK, COLORADO 1979
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 4, WINTER PARK

DATE: 12/15/79

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES							
			RANGE= 19.11 (m)		TIME=1354		
HH	8.20	8.70	6.90	6.29	7.91	6.65	
HV				-2.75	-3.13	-3.42	
VV	8.30	8.50	7.00	7.94	9.75	9.68	

ANGLE=20 DEGREES			RANGE= 20.50 (m)		TIME=1415		
HH		-14.60	-11.70	-15.16	-17.27	-11.57	
HV	-22.20	-23.60	-20.10	-21.53	-23.29	-18.82	
VV	-13.10	-14.10	-12.30	-12.74	-14.11	-9.23	

ANGLE=50 DEGREES			RANGE= 27.10 (m)		TIME=1435		
HH				-17.49	-17.32	-13.40	
HV	-34.00			-21.76	-23.64	-19.49	
VV				-15.46	-15.56	-11.09	

ANGLE=70 DEGREES			RANGE= 56.23 (m)		TIME=1445		
HH	-25.50	-25.10	-20.50	-19.27	-18.62	-15.08	
HV	-34.50	-35.20	-28.50	-25.85	-25.85	-21.79	
VV	-25.00	-25.40		-19.47	-18.07	-13.49	

DATE: 12/16/79

ANGLE= 0 DEGREES			RANGE= 18.75 (m)		TIME= 852		
HH	4.60	6.90	8.30	9.06	7.16	11.06	
HV		-11.30		0.18	-2.09	1.41	
VV	4.70	6.20	8.50	10.48	8.88	12.61	

ANGLE=20 DEGREES			RANGE= 19.92 (m)		TIME= 900		
HH		-15.80	-13.10	-15.78	-14.93	-10.98	
HV	-24.10	-25.50	-22.10	-20.28	-23.14	-17.17	
VV		-16.10		-12.69	-13.66	-10.07	

ANGLE=50 DEGREES			RANGE= 28.89 (m)		TIME= 934		
HH		-22.60	-18.50	-18.55	-17.50	-13.86	
HV	-32.50	-31.40		-24.01	-23.88	-21.53	
VV		-22.00	-17.40	-16.41	-16.80	-13.33	

ANGLE=70 DEGREES			RANGE= 52.83 (m)		TIME= 948		
HH	-27.70	-25.40	-21.40	-19.87	-18.48	-15.86	
HV	-35.50	-34.90	-29.30	-26.69	-24.99	-23.23	
VV	-27.40	-25.90		-18.72	-17.41	-14.43	

WINTER PARK, COLORADO 1979
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 4, WINTER PARK

DATE: 12/16/79

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0	DEGREES	RANGE= 18.55 (m)	TIME=1005
HH	6.10 6.50	8.50 9.76	8.01 10.68
HV	-10.00	-0.11	-2.99 0.92
VV	6.70 6.70	8.80 11.19	8.69 11.52

ANGLE=20	DEGREES	RANGE= 19.92 (m)	TIME=1027
HH	-15.70	-13.10 -13.71	-15.55 -13.38
HV	-24.20 -26.00	-23.50 -20.28	-21.94 -20.07
VV	-15.60	-11.49	-14.76 -10.97

ANGLE=50	DEGREES	RANGE= 29.12 (m)	TIME=1042
HH	-23.90	-19.10 -17.85	-17.35 -14.63
HV	-34.30 -33.70	-28.50 -23.94	-25.01 -20.86
VV	-22.70	-18.50 -16.34	-15.64 -12.37

ANGLE=70	DEGREES	RANGE= 55.83 (m)	TIME=1055
HH	-31.30 -27.50	-23.20 -19.86	-19.40 -16.71
HV	-39.90 -37.70	-32.80 -27.01	-26.51 -23.56
VV	-30.20 -28.00	-19.64	-18.63 -14.46

DATE: 12/16/79

ANGLE= 0	DEGREES	RANGE= 18.85 (m)	TIME=1115
HH	6.80 6.80	9.50 7.53	8.13 10.93
HV	-11.10	-2.57	-2.55 0.66
VV	6.70 6.50	9.70 9.13	9.63 12.86

ANGLE=20	DEGREES	RANGE= 20.03 (m)	TIME=1135
HH	-17.60	-13.20 -15.02	-16.24 -10.96
HV	-26.00	-22.10 -21.03	-22.69 -20.02
VV	-17.00	-13.34	-14.81 -10.92

ANGLE=50	DEGREES	RANGE= 29.01 (m)	TIME=1154
HH	-23.20	-19.50 -20.29	-18.39 -15.68
HV	-35.10	-25.37	-24.85 -21.60
VV	-22.30	-17.80 -16.97	-16.67 -13.30

ANGLE=70	DEGREES	RANGE= 54.29 (m)	TIME=1204
HH	-27.50 -25.60	-22.00 -18.96	-18.79 -16.00
HV	-34.80 -34.90	-28.40 -25.76	-25.05 -22.60
VV	-27.10 -25.60	-18.08	-17.27 -14.00

WINTER PARK, COLORADO 1979
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 4, WINTER PARK

DATE: 12/16/79

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES							
RANGE=			18.45 (m)				
TIME=1222							
HH	7.00	8.00	9.10	8.70	7.86	9.86	
HV				-1.36		0.18	
VV	7.40	7.80	9.00	10.74	10.84	13.17	
ANGLE=20 DEGREES							
RANGE=			19.98 (m)				
TIME=1250							
HH		-15.00	-13.30	-15.43	-14.86	-11.89	
HV	-23.50	-24.50	-21.30	-22.16	-21.91	-19.65	
VV	-12.10	-14.80		-13.16	-12.34	-9.35	
ANGLE=50 DEGREES							
RANGE=			29.35 (m)				
TIME=1315							
HH		-23.10	-19.50	-17.62	-16.51	-13.87	
HV	-34.30	-33.70		-22.17	-23.25	-20.50	
VV		-22.80	-17.90	-15.17	-15.47	-12.60	
ANGLE=70 DEGREES							
RANGE=			55.05 (m)				
TIME=1335							
HH	-28.90	-25.70	-22.70	-19.11	-19.00	-15.90	
HV	-35.20	-35.10	-31.60	-25.23	-25.83	-22.78	
VV	-28.40	-26.40		-18.46	-17.65	-13.88	

DATE: 12/16/79

ANGLE= 0 DEGREES							
RANGE=			18.45 (m)				
TIME=1352							
HH	8.30	7.10	10.10	9.79	9.02	11.82	
HV		-11.10		0.04	-0.93	0.68	
VV	9.00	7.20	10.10	11.64	10.94	13.37	
ANGLE=20 DEGREES							
RANGE=			19.92 (m)				
TIME=1413							
HH		-15.50	-13.50	-14.51	-14.48	-11.27	
HV	-23.80	-25.10	-20.90	-20.68	-21.54	-18.97	
VV		-15.40		-11.99	-13.26	-9.77	
ANGLE=50 DEGREES							
RANGE=			29.01 (m)				
TIME=1432							
HH		-23.80	-19.30	-17.82	-18.67	-13.82	
HV	-34.20	-32.30	-27.40	-23.67	-24.55	-20.40	
VV		-23.10	-18.30	-15.87	-16.97	-12.80	
ANGLE=70 DEGREES							
RANGE=			55.05 (m)				
TIME=1443							
HH	-28.90	-26.10	-21.90	-18.39	-18.45	-16.20	
HV	-37.00	-36.20	-30.00	-25.83	-25.63	-23.08	
VV	-28.70	-26.90		-18.06	-17.15	-14.58	

WINTER PARK, COLORADO 1979
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 4, WINTER PARK

DATE: 12/16/79

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE=	18.55 (m)	TIME=1500		
HH	6.60	7.00	11.00	11.07	9.42	10.33	
HV		-10.50		0.39	-1.69	1.42	
VV	6.30	6.50	10.90	12.69	10.89	12.32	
ANGLE=20 DEGREES			RANGE=	19.87 (m)	TIME=1524		
HH				-14.29	-14.96	-11.43	
HV				-18.41	-21.76	-19.09	
VV				-11.71	-12.69	-10.10	
ANGLE=50 DEGREES			RANGE=	28.78 (m)	TIME=1545		
HH				-20.80	-19.16	-15.17	
HV				-25.24	-25.31	-21.46	
VV				-18.94	-17.94	-14.57	
ANGLE=70 DEGREES			RANGE=	54.67 (m)	TIME=1600		
HH				-20.10	-19.83	-16.95	
HV				-27.80	-27.69	-24.04	
VV				-19.92	-18.91	-14.74	

DATE: 12/16/79

ANGLE= 0 DEGREES			RANGE=	18.31 (m)	TIME=1630		
HH				11.10	10.97	13.32	
HV				1.17	0.40	3.21	
VV				12.27	12.17	14.60	
ANGLE=20 DEGREES			RANGE=	19.70 (m)	TIME=1705		
HH				-13.50	-15.42	-12.05	
HV				-20.28	-21.54	-18.57	
VV				-11.68	-13.26	-10.77	
ANGLE=50 DEGREES			RANGE=	28.56 (m)	TIME=1718		
HH		-24.60	-20.60	-18.26	-17.84	-13.70	
HV	-34.90	-34.10	-29.10	-22.31	-24.98	-21.43	
VV		-22.60	-18.30	-15.91	-16.30	-12.63	
ANGLE=70 DEGREES			RANGE=	55.44 (m)	TIME=1730		
HH	-30.90	-28.70	-23.40	-22.14	-20.45	-17.14	
HV	-34.30	-38.80	-33.60	-29.47	-27.87	-24.02	
VV	-22.40	-28.10		-21.60	-18.79	-14.72	

WINTER PARK, COLORADO 1979
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 4, WINTER PARK

DATE: 12/18/79

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE=	18.65 (m)	TIME=1030		
HH	7.10	5.60	7.90	5.91	5.64	9.48	
HV					-2.91	-0.93	
VV	7.00	5.50	8.10	6.83	8.30	11.94	
ANGLE=20 DEGREES			RANGE=	19.81 (m)	TIME=1100		
HH		-15.60	-12.60	-12.86	-14.19	-9.58	
HV		-25.80	-22.80	-18.39	-20.87	-18.39	
VV		-15.60		-11.25	-12.74	-8.86	
ANGLE=50 DEGREES			RANGE=	28.45 (m)	TIME=1113		
HH		-24.50	-20.00	-18.87	-16.46	-11.81	
HV	-33.60	-33.50		-23.93	-24.33	-19.99	
VV		-23.40	-19.30	-17.85	-16.56	-11.70	
ANGLE=70 DEGREES			RANGE=	51.79 (m)	TIME=1125		
HH	-28.80	-26.10	-23.60	-19.35	-18.84	-15.54	
HV	-36.80	-36.30	-31.20	-25.53	-26.13	-22.08	
VV	-28.10	-27.30		-19.39	-17.82	-13.83	

DATE: 12/18/79

ANGLE= 0 DEGREES			RANGE=	18.45 (m)	TIME=1141		
HH	6.30	4.70	9.00	7.23	6.19	9.37	
HV		-12.60			-2.23	0.48	
VV	6.50	4.20	9.70	8.84	8.44	11.27	
ANGLE=20 DEGREES			RANGE=	19.87 (m)	TIME=1224		
HH		-15.60	-13.90	-13.34	-14.67	-12.00	
HV		-25.30	-20.40	-20.51	-21.16	-19.69	
VV		-15.40		-11.91	-12.79	-10.20	
ANGLE=50 DEGREES			RANGE=	28.78 (m)	TIME=1246		
HH		-22.70	-17.40	-18.14	-17.75	-12.85	
HV	-33.30	-32.40		-23.94	-24.51	-21.86	
VV		-22.30	-17.50	-16.94	-16.74	-12.27	
ANGLE=70 DEGREES			RANGE=	53.55 (m)	TIME=1258		
HH	-27.40	-25.40	-22.20	-18.73	-18.83	-14.81	
HV	-36.40	-35.70	-29.70	-25.17	-25.67	-21.62	
VV	-24.70	-24.10		-18.60	-17.79	-12.72	

WINTER PARK, COLORADO 1979
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 4, WINTER PARK

DATE:12/18/79

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES							
RANGE=			18.50 (m)				
TIME=1313							
HH	7.50	7.20	11.40	6.94	6.76	9.24	
HV		-10.90			-1.21	1.20	
VV	7.90	7.10	12.00	10.66	7.67	11.40	
ANGLE=20 DEGREES							
RANGE=			19.98 (m)				
TIME=1342							
HH		-14.70	-11.20	-13.95	-13.68	-10.08	
HV	-22.20	-24.30	-21.40	-19.06	-21.41	-17.45	
VV		-14.50		-11.96	-12.04	-9.05	
ANGLE=50 DEGREES							
RANGE=			28.67 (m)				
TIME=1402							
HH		-22.70	-17.20	-19.36	-17.07	-12.48	
HV	-31.50	-31.00	-26.20	-24.47	-24.05	-19.50	
VV		-21.30	-16.50	-18.07	-15.67	-11.60	
ANGLE=70 DEGREES							
RANGE=			53.55 (m)				
TIME=1420							
HH	-29.20	-25.30	-22.60	-19.93	-19.26	-15.19	
HV	-37.00	-34.80	-30.20	-26.47	-26.27	-21.92	
VV	-28.70	-26.30		-19.20	-17.69	-14.12	

DATE:12/18/79

ANGLE= 0 DEGREES							
RANGE=			18.41 (m)				
TIME=1434							
HH	8.60	7.30	11.90	8.08	8.54	11.63	
HV					-1.66	1.95	
VV	8.90	6.90	12.30	9.02	10.12	12.35	
ANGLE=20 DEGREES							
RANGE=			19.81 (m)				
TIME=1509							
HH		-13.20	-11.60	-14.97	-15.10	-10.55	
HV	-22.70	-23.80	-21.40	-19.83	-22.09	-18.12	
VV		-12.90	-11.00	-12.63	-12.11	-8.62	
ANGLE=50 DEGREES							
RANGE=			28.45 (m)				
TIME=1521							
HH		-21.50	-18.70	-19.21	-16.88	-14.04	
HV	-34.10	-31.20	-26.60	-23.94	-24.22	-21.37	
VV		-20.50	-16.00	-18.34	-15.94	-13.37	
ANGLE=70 DEGREES							
RANGE=			52.13 (m)				
TIME=1530							
HH	-27.90	-25.50	-21.30	-19.49	-19.56	-16.13	
HV	-35.90	-35.60	-29.80	-25.01	-26.60	-22.25	
VV	-27.70	-26.80		-17.93	-18.02	-14.25	

WINTER PARK, COLORADO 1979
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 4, WINTER PARK

DATE: 12/18/79

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0	DEGREES	RANGE=	18.50 (m)	TIME=1542
HH	8.60 8.40	13.60	9.93	10.43 13.27
HV		-9.40		-0.31 1.70
VV	9.50 8.90	14.00	10.46	11.47 13.90

ANGLE=20	DEGREES	RANGE=	19.98 (m)	TIME=1607
HH		-12.50	-10.70	-14.28 -15.21 -11.37
HV	-22.90	-22.50		-19.76 -20.61 -16.85
VV		-12.30	-10.60	-11.36 -13.24 -9.85

ANGLE=50	DEGREES	RANGE=	28.67 (m)	TIME=1620
HH		-23.70	-19.50	-20.33 -17.67 -14.13
HV	-33.90	-33.20		-24.87 -24.45 -20.50
VV		-21.60	-17.10	-18.27 -16.77 -9.00

ANGLE=70	DEGREES	RANGE=	52.48 (m)	TIME=1630
HH	-25.90	-23.60	-19.80	-18.14 -17.85 -15.42
HV	-33.90	-33.40	-28.50	-23.95 -25.05 -21.39
VV	-26.60	-24.10		-17.07 -16.96 -12.99

DATE: 12/19/79

ANGLE= 0	DEGREES	RANGE=	18.12 (m)	TIME=1840
HH	6.10 7.50	7.00		
HV		-10.50		
VV	5.50 7.30	6.30		

ANGLE=20	DEGREES	RANGE=	19.27 (m)	TIME=1903
HH		-14.80	-12.00	-8.58 -9.76 -8.29
HV	-23.70	-22.90	-19.90	-14.27 -17.23 -17.06
VV		-14.10		-8.88 -7.35 -6.26

ANGLE=50	DEGREES	RANGE=	22.50 (m)	TIME=1930
HH		-21.00	-15.20	-15.59 -16.80 -14.12
HV	-28.80	-27.00	-25.10	-22.18 -23.45 -19.60
VV			-15.40	-14.58 -14.18 -12.61

WINTER PARK, COLORADO 1979
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 4, WINTER PARK

DATE: 12/20/79

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 18.96 (m) TIME= 910

HH 3.50 6.10 4.30

HV

VV 2.40 5.90 3.60

ANGLE=20 DEGREES RANGE= 20.50 (m) TIME= 942

HH -17.40 -13.80 -11.12 -12.13 -8.45

HV -26.50 -24.50 -15.73 -17.99 -16.42

VV -17.10 -8.44 -9.61 -7.03

ANGLE=50 DEGREES RANGE= 24.39 (m) TIME=1004

HH -21.30 -18.70 -15.46 -15.62 -12.62

HV -31.60 -32.00 -28.50 -20.38 -22.45 -19.70

VV -20.70 -18.60 -14.48 -13.67 -12.20

DATE: 12/20/79

ANGLE= 0 DEGREES RANGE= 18.55 (m) TIME=1120

HH 8.70 7.20 11.30 8.11 6.56 8.19

HV -1.19 0.72

VV 9.30 7.70 11.40 10.39 7.59 8.62

ANGLE=20 DEGREES RANGE= 19.75 (m) TIME=1150

HH -14.80 -11.80 -12.67 -13.50 -11.73

HV -23.10 -24.40 -21.90 -18.96 -22.51 -19.24

VV -12.60 -14.60 -11.60 -8.26 -13.64 -11.55

ANGLE=50 DEGREES RANGE= 28.56 (m) TIME=1208

HH -22.90 -22.10 -19.90 -18.69 -17.81 -12.50

HV -32.80 -28.20 -24.11 -25.08 -19.33

VV -22.10 -21.00 -18.70 -17.31 -17.10 -11.13

ANGLE=70 DEGREES RANGE= 53.19 (m) TIME=1220

HH -25.80 -25.20 -22.50 -18.74 -17.97 -14.29

HV -34.80 -34.90 -29.90 -24.63 -24.93 -20.98

VV -25.90 -25.30 -17.46 -16.55 -12.48

WINTER PARK, COLORADO 1979
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 4, WINTER PARK

DATE: 12/20/79

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.80 (m)	TIME=1235			
HH	9.70	8.10	11.80	8.62	8.64	11.54	
HV		-9.50			-2.17	1.44	
VV	9.80	8.10	12.00	9.50	10.61	13.53	
ANGLE=20 DEGREES			RANGE= 20.09 (m)	TIME=1304			
HH		-15.80	-11.80	-13.59	-15.42	-10.15	
HV	-22.40	-24.80	-21.40	-20.41	-21.77	-18.30	
VV	-12.20	-14.70	-11.40	-10.51	-13.19	-8.10	
ANGLE=50 DEGREES			RANGE= 28.13 (m)	TIME=1320			
HH		-21.60	-19.00	-18.56	-17.15	-13.32	
HV	-33.50	-31.80	-28.90	-23.44	-24.31	-21.16	
VV		-21.40	-18.60	-16.04	-16.44	-11.67	
ANGLE=70 DEGREES			RANGE= 52.48 (m)	TIME=1327			
HH	-26.90	-24.60	-21.30	-19.16	-17.71	-14.22	
HV	-34.40	-33.00	-27.10	-25.35	-25.15	-20.29	
VV	-26.70	-24.90		-17.97	-16.66	-12.19	

DATE: 12/20/79

ANGLE= 0 DEGREES			RANGE= 20.56 (m)	TIME=1503			
HH	7.30	8.80	6.70	5.38	-0.73	0.63	
HV		-8.20			-7.50	-6.09	
VV	8.10	9.30	7.30	8.48	1.88	2.41	
ANGLE=20 DEGREES			RANGE= 21.17 (m)	TIME=1533			
HH		-10.80	-9.00	-9.76	-9.20	-9.55	
HV	-21.10	-22.20	-18.60	-14.65	-16.61	-16.24	
VV	-9.90	-10.50	-8.80	-8.16	-7.93	-7.55	
ANGLE=50 DEGREES			RANGE= 24.73 (m)	TIME=1603			
HH		-20.80	-16.50	-16.88	-17.39	-13.71	
HV	-27.50	-26.00	-22.70	-22.06	-23.73	-21.48	
VV	-18.30	-18.70	-15.20	-15.06	-16.06	-11.79	

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/ 5/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.75 (m)	TIME=1030			
HH	1.10	-1.30		5.94	5.00	4.46	
HV		-17.60	-10.40	-2.83	-4.55	-5.79	
VV	1.40	-1.00	0.60	7.53	6.36	5.19	
ANGLE=20 DEGREES			RANGE= 20.32 (m)	TIME=1107			
HH		-10.20	-10.50	-10.26	-12.43	-10.26	
HV	-23.80	-20.20	-16.60	-14.12	-16.03	-15.30	
VV	-11.80	-10.80	-9.50	-6.16	-9.61	-4.82	
ANGLE=50 DEGREES			RANGE= 29.46 (m)	TIME=1130			
HH	-19.10	-17.90	-16.40	-14.68	-14.46	-12.57	
HV	-30.70	-26.50	-22.30	-17.95	-20.27	-19.16	
VV	-19.00	-18.60	-15.80	-11.99	-11.45	-10.58	
ANGLE=70 DEGREES			RANGE= 56.23 (m)	TIME=1145			
HH	-29.30	-25.40	-23.60	-15.76	-17.29	-14.65	
HV	-38.60	-34.10	-29.80	-21.07	-23.31	-21.69	
VV	-27.90	-26.00		-14.92	-14.79	-12.61	

DATE: 1/ 5/80

ANGLE= 0 DEGREES			RANGE= 18.60 (m)	TIME=1200			
HH	5.70	0.40	2.10	4.95	10.15	6.47	
HV		-17.10		-3.40	0.28	-3.56	
VV	6.30	0.40	3.10	7.16	10.19	7.02	
ANGLE=20 DEGREES			RANGE= 20.32 (m)	TIME=1230			
HH		-11.70	-7.90	-9.13	-10.91	-10.00	
HV		-23.90	-17.80	-13.82	-15.73	-14.50	
VV		-11.50	-8.30	-5.86	-7.41	-7.22	
ANGLE=50 DEGREES			RANGE= 29.35 (m)	TIME=1251			
HH		-17.80		-14.33	-15.01	-13.92	
HV		-26.90		-17.19	-20.71	-19.10	
VV	-20.50	-18.30		-12.22	-13.19	-11.32	
ANGLE=70 DEGREES			RANGE= 55.05 (m)	TIME=1317			
HH	-29.30	-24.90		-16.89	-17.97	-16.40	
HV		-34.80		-21.55	-23.79	-23.18	
VV	-27.30	-26.30		-16.11	-15.47	-13.90	

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/ 5/80
FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0	DEGREES	RANGE= 18.60 (m)	TIME=1345
HH	4.70 1.50	2.80 3.92	11.24 4.93
HV	-16.40	-4.20	2.28 -4.56
VV	4.90 1.80	3.10 6.06	14.19 8.02

ANGLE=20	DEGREES	RANGE= 20.38 (m)	TIME=1407
HH	-8.70	-5.00 -9.67	-9.98 -9.63
HV	-24.40 -20.50	-13.40	-15.70 -14.17
VV	-10.90 -9.20	-1.60 -5.74	-5.98 -7.00

ANGLE=50	DEGREES	RANGE= 29.35 (m)	TIME=1429
HH	-17.60	-10.60 -14.37	-14.86 -13.48
HV	-30.60 -24.40	-17.89	-20.61 -20.20
VV	-20.60 -18.60	-12.60 -11.32	-11.79 -11.82

ANGLE=70	DEGREES	RANGE= 54.67 (m)	TIME=1442
HH	-29.70 -25.10	-6.70 -17.19	-17.75 -14.53
HV	-37.50 -32.90	-21.71	-23.45 -20.94
VV	-27.80 -24.90	-15.57	-15.63 -12.06

DATE: 1/ 5/80

ANGLE=50	DEGREES	RANGE= 29.52 (m)	TIME=1557
HH	-19.30 -17.50	-14.00 -14.04	-14.73 -13.82
HV	-25.50 -24.10	-19.60 -17.77	-20.97 -18.59
VV	-19.20 -17.50	-14.10 -11.60	13.05

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/ 6/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES							
RANGE=			19.16 (m)				
TIME=1100							
HH 0.50	-0.80	3.00	2.54	4.06	3.50		
HV			-3.34	-5.47	-4.80		
VV -0.30	-0.50	3.90	4.52	6.25	7.28		
ANGLE=20 DEGREES							
RANGE=			20.56 (m)				
TIME=1125							
HH	-9.90	-9.00	-8.28	-9.63	-7.74		
HV	-27.90		-11.82	-15.03	-13.70		
VV -11.30	-10.00	-8.10	-6.26	-7.71	-4.72		
ANGLE=50 DEGREES							
RANGE=			29.70 (m)				
TIME=1140							
HH -20.10	-17.30	-16.10	-14.00	-14.45	-11.97		
HV	-32.20		-16.98	-19.10	-18.89		
VV -20.20	-18.70	-14.90	-12.12	-11.08	-8.72		
ANGLE=70 DEGREES							
RANGE=			53.19 (m)				
TIME=1152							
HH -30.50	-25.40	-22.60	-17.27	-17.76	-15.43		
HV	-40.00		-21.75	-23.69	-22.48		
VV -27.90	-25.80		-16.01	-15.47	-12.30		

DATE: 1/ 6/80

ANGLE= 0 DEGREES							
RANGE=			18.70 (m)				
TIME=1210							
HH 4.50	4.10	6.10	9.85	10.48	10.68		
HV			0.04	0.42	1.39		
VV 4.50	4.00	6.80	11.61	13.24	13.47		
ANGLE=20 DEGREES							
RANGE=			20.44 (m)				
TIME=1233							
HH	-9.90	-6.90	-8.66	-10.37	-7.37		
HV	-25.80		-12.07	-14.28	-14.55		
VV -11.20	-9.40	-6.40	-6.61	-7.36	-4.27		
ANGLE=50 DEGREES							
RANGE=			29.23 (m)				
TIME=1253							
HH	-17.90	-15.60	-13.55	-13.27	-11.83		
HV	-31.40		-17.82	-19.94	-17.63		
VV -20.60	-18.80	-15.40	-12.16	-11.42	-8.15		
ANGLE=70 DEGREES							
RANGE=			53.55 (m)				
TIME=1307							
HH -30.20	-24.60	-22.90	-16.67	-17.09	-15.47		
HV	-39.70		-21.09	-23.23	-22.02		
VV -26.90	-24.70		-15.85	-14.91	-11.84		

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/ 6/80

FREQUENCY (GHZ)
1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 19.01 (m) TIME=1348
HH 4.00 3.60 5.20 5.78 8.06 8.22
HV -0.92 -0.54 1.03
VV 3.90 3.70 5.60 7.55 11.18 13.11

ANGLE=20 DEGREES RANGE= 20.50 (m) TIME=1436
HH -8.10 -7.70 -7.05 -9.12 -8.23
HV -12.55 -14.75 -12.52
VV -8.90 -8.10 -6.60 -5.39 -7.33 -4.95

ANGLE=50 DEGREES RANGE= 29.82 (m) TIME=1450
HH -19.10 -16.50 -14.30 -14.99 -13.81 -12.66
HV -32.90 -16.45 -19.27 -17.76
VV -19.00 -17.00 -15.00 -13.08 -11.45 -8.58

ANGLE=70 DEGREES RANGE= 52.48 (m) TIME=1500
HH -28.90 -22.90 -21.10 -17.27 -17.73 -14.67
HV -38.70 -21.16 -23.21 -21.29
VV -26.40 -23.90 -16.52 -15.48 -11.71

DATE: 1/ 7/80

ANGLE= 0 DEGREES RANGE= 19.16 (m) TIME= 952
HH 6.60 4.90 6.00 4.10 4.28 6.86
HV -5.54 -4.17 -0.90
VV 5.40 4.80 5.50 6.42 7.35 10.18

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/ 7/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES	RANGE= 18.60 (m)	TIME=1454
HH 4.10 0.90	5.40 1.84	1.61 0.97
HV -16.90	-5.30	-6.12 -8.36
VV 4.40 1.30	5.90 3.76	3.89 3.82

ANGLE=20 DEGREES	RANGE= 20.26 (m)	TIME=1523
HH -10.30	-8.70 -8.89	-10.34 -9.37
HV -21.10	-17.60 -11.85	-14.95 -14.22
VV -11.90 -9.90	-8.10 -5.49	-8.33 -6.55

ANGLE=50 DEGREES	RANGE= 29.46 (m)	TIME=1536
HH -20.10 -16.90	-13.90 -13.06	-13.82 -11.13
HV -28.10 -24.10	-20.70 -15.55	-20.87 -18.06
VV -20.20 -18.90	-14.90 -11.69	-12.05 -9.48

ANGLE=70 DEGREES	RANGE= 57.45 (m)	TIME=1551
HH -31.30 -25.90	-23.90 -19.35	-18.34 -15.61
HV -39.30 -33.70	-30.10 -23.78	-24.62 -23.61
VV -28.00 -26.00	-17.34	-16.40 -14.83

DATE: 1/ 9/80

ANGLE= 0 DEGREES	RANGE= 18.00 (m)	TIME=1019
HH 7.20 4.90	8.30	
HV -9.60		
VV 7.80 4.70	8.70	

ANGLE=20 DEGREES	RANGE= 19.40 (m)
HH -8.50	-9.30
HV -22.70 -20.20	-16.80
VV -10.50 -8.20	-9.20

ANGLE=50 DEGREES	RANGE= 29.00 (m)
HH -18.00	-16.00
HV -32.00 -26.40	-24.20
VV -21.00 -18.20	-16.20

ANGLE=70 DEGREES	RANGE= 51.90 (m)
HH -30.00 -23.60	-21.40
HV -38.60 -33.50	-29.90
VV -26.50 -24.90	

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/ 9/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 18.00 (m) TIME=1147

HH 9.10 5.80 7.20

HV

VV 9.70 5.60 7.70

ANGLE=20 DEGREES RANGE= 19.20 (m)

HH -8.90 -7.80

HV -21.40 -21.60 -18.20

VV -10.30 -8.90 -7.50

ANGLE=50 DEGREES RANGE= 29.00 (m)

HH -18.10 -13.90

HV -31.20 -27.30 -21.10

VV -20.70 -18.20 -14.80

ANGLE=70 DEGREES RANGE= 51.40 (m)

HH -29.60 -24.40 -21.40

HV -37.10 -32.60 -27.70

VV -26.90 -25.00

DATE: 1/ 9/80

ANGLE= 0 DEGREES RANGE= 18.10 (m) TIME=1320

HH 10.00 6.80 9.30

HV -8.80

VV 10.50 6.40 9.80

ANGLE=20 DEGREES RANGE= 19.30 (m)

HH -7.50 -6.80

HV -19.90 -18.90 -15.00

VV -9.50 -7.30 -7.10

ANGLE=50 DEGREES RANGE= 29.00 (m)

HH -20.20 -16.10 -14.10

HV -28.60 -23.90 -22.50

VV -19.60 -17.40 -14.90

ANGLE=70 DEGREES RANGE= 51.70 (m)

HH -29.40 -22.40 -20.40

HV -34.90 -30.10 -26.60

VV -26.70 -23.20

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/ 9/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 18.50 (m) TIME=1433

HH 9.10 4.90 6.30

HV

VV 9.40 4.50 6.30

DATE: 1/10/80

ANGLE= 0 DEGREES RANGE= 18.80 (m) TIME=1117

HH 6.90 5.10 9.90 9.67 4.95 5.88 3.23

HV 0.08 -4.78 -2.99

VV 7.90 5.30 10.70 9.85 6.03 6.88 2.80

ANGLE=20 DEGREES RANGE= 20.44 (m) TIME=1143

HH -14.50 -8.50 -8.79 -9.31 -10.88 -4.27

HV -27.50 -10.85 -16.69 -17.23

VV -14.60 -8.70 -6.86 -6.52 -8.04 -4.55

ANGLE=50 DEGREES RANGE= 29.94 (m) TIME=1203

HH -19.40 -15.40 -14.54 -14.69 -15.88 -4.99

HV -30.50 -18.12 -21.47 -20.77

VV -19.70 -15.10 -13.60 -13.10 -12.81 -5.59

DATE: 1/10/80

ANGLE=50 DEGREES RANGE= 24.89 (m) TIME=1408

HH -18.50 -16.60 -18.02 -20.71 -20.62 -16.74

HV -30.80 -21.03 -26.48

VV -19.50 -18.30 -16.70 -14.90 -18.21 -17.90 -15.73

DATE: 1/10/80

ANGLE=50 DEGREES RANGE= 24.73 (m) TIME=1437

HH -20.00 -16.60 -17.65 -20.68 -21.55 -16.46

HV -31.70 -21.86 -26.22 -26.96

VV -19.50 -15.90 -14.52 -19.16 -18.09 -16.41

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/11/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE=20	DEGREES	RANGE=	20.86 (m)	TIME=1222		
HH	-10.40	-9.70	-7.03	-7.52	-8.05	-2.38
HV	-25.40		-10.01	-12.75	-12.82	
VV	-12.70	-10.20	-10.80	-4.83	-5.51	-6.37
						-1.13
ANGLE=50	DEGREES	RANGE=	30.92 (m)	TIME=1246		
HH	-21.40	-17.50	-14.10	-13.46	-13.43	-12.00
HV		-32.40		-17.50	-19.35	-18.59
VV	-21.40	-18.90	-15.10	-12.14	-11.50	-10.11
						-1.34
ANGLE=70	DEGREES	RANGE=	61.94 (m)	TIME=1258		
HH	-31.50	-29.10	-25.80	-18.51	-17.68	-16.21
HV		-40.40	-35.90	-23.19	-24.74	-22.99
VV	-30.20	-28.00		-16.96	-15.35	-14.11
						-4.92

DATE: 1/11/80

ANGLE=20	DEGREES	RANGE=	19.30 (m)	TIME=1400
HH	-10.80	-8.00		
HV	-26.30			
VV	-11.30	-10.30	-6.90	
ANGLE=50	DEGREES	RANGE=	29.00 (m)	
HH	-20.10	-18.00	-11.80	
HV		-33.40		
VV	-20.50	-18.80	-11.30	
ANGLE=70	DEGREES	RANGE=	55.20 (m)	
HH	-27.60	-23.10	-15.20	
HV		-36.70		
VV	-26.30	-23.40		

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/13/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE=20 DEGREES RANGE= 20.40 (m) TIME=1035

HH -7.50 -11.50 -11.40
HV -18.90 -20.70
VV -7.20 -10.50 -9.70

ANGLE=50 DEGREES RANGE= 28.23 (m)

HH -20.10 -22.20 -21.33 -13.90 -8.70
HV -25.30 -28.70
VV -17.70 -18.90 -20.50

ANGLE=70 DEGREES RANGE= 47.11 (m)

HH -28.20 -35.20 -32.60 -25.76 -19.20 -13.51
HV -31.80 -35.70 -36.10
VV -22.00 -22.40

DATE: 1/13/80

ANGLE=20 DEGREES RANGE= 20.10 (m) TIME=1115

HH -5.60 -6.90 -5.80
HV -15.60 -19.50 -16.60
VV -5.60 -6.60 -4.70

ANGLE=50 DEGREES RANGE= 29.10 (m)

HH -16.00 -19.10 -21.30
HV -20.70 -24.60 -26.10
VV -14.70 -17.00 -18.10

ANGLE=70 DEGREES RANGE= 51.00 (m)

HH -22.80 -28.80 -29.00
HV -30.40 -34.00 -33.70
VV -21.60 -22.30

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/13/80

FREQUENCY (GHZ)
1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE=50 DEGREES RANGE= 28.23 (m) TIME=1155
HH -21.15 -15.71 -10.82
HV
VV

ANGLE=70 DEGREES RANGE= 47.11 (m)
HH -23.67 -19.85 -14.70
HV
VV

DATE: 1/13/80

ANGLE= 0 DEGREES RANGE= 19.40 (m) TIME=1348
HH 11.20 15.90 15.00
HV -2.20
VV 11.30 15.70 14.80

ANGLE=20 DEGREES RANGE= 20.32 (m) TIME=1348
HH -2.90 -3.10 -6.10 -7.26 -10.68 -10.05 -9.16
HV -12.80 -15.50 -15.30 -12.29 -17.91 -17.17
VV -3.60 -2.70 -5.20 -3.22 -7.06 -5.92 -9.81

ANGLE=50 DEGREES RANGE= 28.23 (m) TIME=1420
HH -14.80 -16.90 -18.60 -21.35 -22.71 -21.21 -13.39
HV -21.70 -23.60 -25.50 -24.97 -26.65 -25.54
VV -15.90 -17.10 -16.70 -17.57 -18.21 -15.65 -12.03

ANGLE=70 DEGREES RANGE= 47.11 (m) TIME=1435
HH -24.70 -27.40 -26.70 -27.20 -29.69 -27.43 -18.86
HV -29.00 -30.50 -30.80 -30.89 -32.70 -31.19
VV -22.60 -22.70 -23.20 -21.92 -22.05 -20.86 -16.09

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/13/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 19.21 (m)	TIME=1540			
HH	11.10	15.60	16.10	11.28	6.45	5.13	3.10
HV		-2.40		3.57	-1.77	-1.89	
VV	12.20	15.80	15.80	15.31	10.07	9.15	2.33
ANGLE=20 DEGREES			RANGE= 20.26 (m)	TIME=1610			
HH	-4.00	-5.70	-4.90	-9.62	-11.72	-10.87	-7.98
HV	-17.00	-15.20		-13.28	-18.64	-20.33	
VV	-4.40	-5.20	-4.30	-6.10	-9.87	-9.60	-8.43
ANGLE=50 DEGREES			RANGE= 27.92 (m)	TIME=1627			
HH	-16.60	-15.30	-15.60	-19.56	-19.19	-18.59	-10.68
HV	-23.60	-23.30	-23.00	-24.19	-25.89	-27.19	
VV	-17.20	-15.70	-15.10	-16.33	-16.70	-16.13	-11.53
ANGLE=70 DEGREES			RANGE= 47.11 (m)	TIME=1640			
HH	-26.40	-24.30	-24.60	-21.53	-22.15	-22.55	-15.45
HV	-31.40	-30.50	-30.60	-28.45	-30.18	-30.04	
VV	-23.60	-22.50	-22.60	-21.55	-22.61	-21.48	-14.62

DATE: 1/14/80

ANGLE= 0 DEGREES			RANGE= 18.75 (m)	TIME=1104			
HH	14.30		18.90	13.43	12.86	11.23	3.51
HV				7.13	4.28	5.93	
VV	15.00		18.80	16.54	16.43	15.72	2.38
ANGLE=20 DEGREES			RANGE= 19.92 (m)	TIME=1137			
HH	-4.80	-6.90	-6.60	-9.76	-10.64	-9.65	-6.31
HV	-16.30	-18.60		-16.23	-18.02	-18.06	
VV	-4.50	-6.30	-6.20	-6.22	-6.16	-5.08	-6.18
ANGLE=50 DEGREES			RANGE= 27.60 (m)	TIME=1202			
HH	-16.40	-18.70	-19.70	-20.35	-19.71	-17.82	-14.45
HV	-24.50	-25.30		-23.54	-25.25	-23.20	
VV	-16.30	-17.70	-18.20	-15.94	-15.27	-13.04	-13.19
ANGLE=70 DEGREES			RANGE= 46.27 (m)	TIME=1219			
HH	-31.20	-33.10	-29.60	-24.81	-26.05	-25.00	-20.90
HV	-34.40	-34.70		-30.01	-31.44	-30.61	
VV	-23.90	-26.20	-25.80	-21.32	-21.23	-20.02	-18.55

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/15/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE=50 DEGREES RANGE= 28.70 (m) TIME=1024

HH -19.60

HV -28.50 -28.20

VV -19.90 -20.10

DATE: 1/15/80

ANGLE=50 DEGREES RANGE= 28.23 (m) TIME=1100

HH -21.50 -18.93 -15.70 -7.90

HV -29.50 -27.10

VV -20.50 -21.60

DATE: 1/15/80

ANGLE=50 DEGREES RANGE= 27.92 (m) TIME=1115

HH -21.40 -18.05 -17.18 -8.70

HV -30.00 -28.90

VV -20.90 -20.90

DATE: 1/15/80

ANGLE=50 DEGREES RANGE= 28.45 (m) TIME=1130

HH -20.80 -19.85 -19.49 -9.74

HV -29.00 -28.90

VV -20.20 -20.20

DATE: 1/15/80

ANGLE=50 DEGREES RANGE= 27.92 (m) TIME=1150

HH -20.60 -19.20 -19.02 -18.88 -9.00

HV -28.70 -30.30

VV -20.60 -20.70 -18.20

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/15/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE=50 DEGREES RANGE= 28.02 (m) TIME=1210
HH -19.70 -20.90 -18.99 -19.00 -9.27
HV -30.10 -29.00 -29.50
VV -19.70 -20.30

DATE: 1/15/80

ANGLE=50 DEGREES RANGE= 28.80 (m) TIME=1225
HH -20.20 -20.50 -19.10
HV -29.70 -29.80 -28.30
VV -20.20 -20.20 -19.70

DATE: 1/15/80

ANGLE=50 DEGREES RANGE= 28.13 (m) TIME=1250
HH -20.30 -20.80 -18.50 -19.89 -17.58 -9.74
HV -28.70 -30.50
VV -20.00 -21.40 -18.00

DATE: 1/15/80

ANGLE=50 DEGREES RANGE= 27.71 (m) TIME=1305
HH -20.40 -19.70 -20.30 -20.13 -19.44 -9.77
HV -29.70 -30.50 -29.20
VV -20.50 -20.00 -20.90

DATE: 1/15/80

ANGLE=50 DEGREES RANGE= 27.30 (m) TIME=1321
HH -20.10 -19.00 -18.70 -20.78 -20.64 -10.00
HV -28.60 -29.00 -28.50
VV -19.10 -18.40 -19.40

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/15/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE=50 DEGREES RANGE= 27.60 (m) TIME=1335
HH -20.30 -18.40 -19.10 -20.88 -19.89 -10.80
HV -28.10 -28.10 -28.20
VV -19.00 -17.00 -18.70

DATE: 1/15/80

ANGLE=50 DEGREES RANGE= 27.40 (m) TIME=1357
HH -20.30 -19.90 -20.80 -21.34 -21.56 -11.06
HV -30.30 -29.90 -30.30
VV -19.70 -19.30 -21.60

DATE: 1/15/80

ANGLE=50 DEGREES RANGE= 26.23 (m) TIME=1425
HH -20.10 -18.90 -18.90 -21.21 -22.08 -11.14
HV -29.80 -30.00
VV -20.00 -19.10 -20.30

DATE: 1/15/80

ANGLE=50 DEGREES RANGE= 27.27 (m) TIME=1453
HH -19.90 -17.90 -20.30 -21.69 -23.38 -20.73 -10.35
HV -28.00 -28.70 -28.20 -26.97 -30.09 -27.81
VV -19.00 -17.50 -20.30 -18.96 -19.89 -17.58 -12.22

DATE: 1/15/80

ANGLE=50 DEGREES RANGE= 27.14 (m) TIME=1513
HH -19.30 -18.90 -21.73 -22.50 -19.04 -11.49
HV -28.90 -29.70 -29.10 -27.40 -29.30 -27.25
VV -19.30 -19.40 -20.70 -19.18 -20.37 -17.04 -12.87

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (JB)
TEST SITE # 1, HIBBERT

DATE: 1/15/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE=50	DEGREES	RANGE=	27.42 (m)	TIME=1532	
HH	-19.50 -18.70	-16.90	-21.27	-22.39 -20.75	-11.60
HV	-29.00 -29.30		-27.11	-28.71 -27.25	
VV	-19.60 -19.40	-18.40	-18.33	-20.20 -17.54	-13.22

DATE: 1/15/80

ANGLE=50	DEGREES	RANGE=	27.39 (m)	TIME=1547	
HH	-20.20 -18.40	-18.70	-22.87	-22.46 -20.32	-10.87
HV	-28.30 -28.00	-27.80	-28.42	-29.51 -27.07	
VV	-18.90 -17.70	-19.50	-19.39	-19.49 -17.53	-12.37

DATE: 1/15/80

ANGLE=50	DEGREES	RANGE=	27.34 (m)	TIME=1610	
HH	-20.40 -18.70	-19.50	-22.69	-21.24 -19.78	-9.06
HV	-29.10 -28.70	-28.00	-28.12	-29.17 -26.30	
VV	-19.10 -18.60	-21.40	-19.49	-18.64 -17.98	-10.85

DATE: 1/15/80

ANGLE=50	DEGREES	RANGE=	27.37 (m)	TIME=1630	
HH	-19.30 -18.60	-18.10	-20.01	-19.78 -17.58	-7.33
HV	-29.50 -28.00	-28.80	-25.79	-25.87 -23.85	
VV	-19.20 -19.10	-20.60	-17.34	-17.08 -16.07	-9.36

DATE: 1/15/80

ANGLE=50	DEGREES	RANGE=	28.08 (m)	TIME=1654	
HH	-19.40 -17.20	-18.70	-20.24	-19.73 -17.85	-4.93
HV	-28.40 -27.10	-26.30	-26.50	-26.89 -22.98	
VV	-18.60 -17.70	-17.50	-17.93	-18.70 -15.36	-5.79

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/15/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE=50 DEGREES RANGE= 27.91 (m) TIME=1715
HH -19.70 -17.30 -18.10 -20.58 -19.12 -16.58 -3.75
HV -28.80 -26.80 -26.80 -26.75 -26.38 -22.86
VV -19.50 -17.90 -18.30 -17.85 -17.99 -13.83 -4.62

DATE: 1/16/80

ANGLE=50 DEGREES RANGE= 28.70 (m) TIME= 958
HH -16.60 -16.98 -12.82 -0.35
HV -22.71 -24.86 -19.37
VV -15.36 -16.22 -11.79 -0.92

DATE: 1/16/80

ANGLE=50 DEGREES RANGE= 28.80 (m) TIME=1018
HH -14.19 -14.46 -11.61 -0.43
HV -17.94 -21.72 -18.70
VV -12.79 -12.61 -9.13 -0.22

DATE: 1/16/80

ANGLE=50 DEGREES RANGE= 29.70 (m) TIME=1036
HH -19.30 -17.20 -16.90
HV -27.00 -24.30 -22.00
VV -18.70 -17.10 -17.50

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/16/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 18.60 (m) TIME=1053

HH 11.70 15.20 16.60

HV

VV 12.30 15.40 17.80

ANGLE=20 DEGREES RANGE= 19.50 (m)

HH -9.60 -9.10

HV -21.00 -21.20 -16.80

VV -9.50 -9.70 -9.10

ANGLE=50 DEGREES RANGE= 29.00 (m)

HH -20.00 -16.90 -17.10

HV -26.30 -23.70 -20.70

VV -18.80 -17.40 -16.30

ANGLE=70 DEGREES RANGE= 52.80 (m)

HH -28.00 -25.10 -23.60

HV -34.60 -32.20 -28.30

VV -26.60 -25.50

DATE: 1/16/80

ANGLE= 0 DEGREES RANGE= 18.60 (m) TIME=1300

HH 8.30 11.40 12.80

HV -5.20 -5.50

VV 9.20 11.70 13.40

ANGLE=20 DEGREES RANGE= 19.32 (m)

HH -8.10 -8.10 -7.90 -8.28 -9.19 -1.24

HV -19.80 -18.40 -16.10

VV -8.70 -8.80 -8.30

ANGLE=50 DEGREES RANGE= 27.10 (m)

HH -18.80 -16.90 -18.40 -14.65 -3.66

HV -28.90 -25.90 -24.40

VV -20.10 -18.50 -17.90

ANGLE=70 DEGREES RANGE= 53.19 (m)

HH -28.40 -26.20 -23.40 -22.14 -17.24 -7.45

HV -35.30 -32.10 -29.20

VV -25.90 -25.40

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/16/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 18.50 (m) TIME=1356

HH 10.60 13.90 15.20

TV

VV 11.70 14.20 15.90

ANGLE=20 DEGREES RANGE= 19.32 (m)

HH -10.20 -8.00 -11.35 -11.51 -5.64

HV -19.00 -20.00 -15.90

VV -8.60 -10.00 -7.20

ANGLE=50 DEGREES RANGE= 27.60 (m)

HH -19.30 -16.10 -15.30 -18.36 -14.48 -7.80

HV -25.20 -22.20 -20.40

VV -17.90 -16.00 -14.30

ANGLE=70 DEGREES RANGE= 50.78 (m)

HH -28.60 -25.60 -24.80 -23.07 -19.62 -11.15

HV -35.00 -31.20 -29.90

VV -26.60 -24.90

DATE: 1/16/80

ANGLE= 0 DEGREES RANGE= 18.40 (m) TIME=1530

HH 7.60 12.50 12.20

HV -5.80 -4.10

VV 8.50 12.40 12.70

ANGLE=20 DEGREES RANGE= 19.37 (m)

HH -7.60 -8.70 -8.60 -10.46 -10.84 -4.12

HV -19.30 -17.90 -16.50

VV -8.50 -8.80 -8.40

ANGLE=50 DEGREES RANGE= 27.71 (m)

HH -19.40 -17.40 -15.20 -17.62 -14.79 -5.27

HV -27.20 -24.00 -21.10

VV -18.80 -17.10 -14.70

ANGLE=70 DEGREES RANGE= 51.11 (m)

HH -27.70 -24.10 -22.80 -22.27 -20.00 -8.49

HV -34.40 -31.00 -28.10

VV -26.10 -24.10

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/16/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE=50 DEGREES RANGE= 28.23 (m) TIME=1635
HH -20.10 -18.60 -14.50 -17.07 -14.49 -3.40
HV -27.80 -25.20 -23.60
VV -19.40 -18.20 -15.70

DATE: 1/18/80

ANGLE= 0 DEGREES RANGE= 18.45 (m) TIME=1032
HH 8.50 7.70 10.20 11.36 9.43 9.07 2.71
HV -7.40 2.88 1.06 -0.74
VV 8.60 7.40 10.60 15.22 13.13 12.43 1.98

ANGLE=20 DEGREES RANGE= 19.87 (m) TIME=1100
HH -7.50 -7.80 -7.50 -4.96 -6.71 -4.25 0.28
HV -19.90 -20.10 -14.40 -11.96 -12.37 -11.38
VV -7.30 -8.60 -7.60 -2.93 -3.51 -1.83 -0.17

ANGLE=50 DEGREES RANGE= 29.23 (m) TIME=1115
HH -19.80 -17.60 -15.50 -15.46 -12.48 -9.84 0.30
HV -25.90 -25.10 -20.60 -18.25 -18.37 -16.07
VV -19.20 -17.20 -14.80 -11.32 -10.61 -7.42 0.09

ANGLE=70 DEGREES RANGE= 54.29 (m) TIME=1130
HH -29.30 -24.70 -22.10 -16.54 -14.88 -10.53 -5.56
HV -35.30 -30.40 -24.20 -21.66 -22.23 -18.90
VV -27.70 -24.90 -14.97 -14.10 -10.88 -3.50

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/18/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.50 (m)			TIME=1145	
HH	8.80	7.60	9.60	10.39	9.99	8.76	3.03
HV	-4.90	-7.20		2.64	1.87	-0.78	
VV	9.10	7.30	9.70	14.51	13.13	12.43	1.75
ANGLE=20 DEGREES			RANGE= 20.09 (m)			TIME=1205	
HH		-9.40	-8.40	-5.75	-6.69	-4.98	0.96
HV	-19.80	-18.40	-15.60	-11.63	-13.53	-11.24	
VV	-9.60	-9.40	-9.00	-2.30	-3.07	-1.72	-0.06
ANGLE=50 DEGREES			RANGE= 29.12 (m)			TIME=1225	
HH	-19.40	-17.50	-14.50	-15.06	-11.71	-9.04	-0.08
HV	-25.70	-24.30	-20.30	-18.46	-18.51	-14.95	
VV	-19.40	-16.80	-13.80	-10.54	-9.72	-6.75	-0.49
ANGLE=70 DEGREES			RANGE= 54.67 (m)			TIME=1232	
HH	-27.70	-24.20	-21.10	-16.72	-14.23	-10.63	-5.30
HV	-34.00	-29.50	-23.40	-21.62	-22.07	-18.42	
VV	-27.10	-24.40		-15.50	-13.93	-10.88	-3.31

DATE: 1/18/80

ANGLE= 0 DEGREES			RANGE= 18.50 (m)			TIME=1251	
HH	11.70	10.80	10.80	10.84	11.65	11.19	2.73
HV		-4.60		3.74	3.51	1.89	
VV	11.70	10.90	11.10	15.18	14.39	13.72	1.57
ANGLE=20 DEGREES			RANGE= 19.92 (m)			TIME=1315	
HH	-7.70	-7.20	-6.50	-5.34	-6.48	-4.91	0.70
HV	-17.40	-16.90	-15.50	-12.09	-12.57	-11.47	
VV	-7.40	-7.60	-7.20	-2.28	-3.19	-2.91	-0.47
ANGLE=50 DEGREES			RANGE= 29.01 (m)			TIME=1328	
HH	-20.60	-17.80	-15.60	-14.71	-12.33	-9.17	
HV	-28.50	-24.40	-20.90	-18.98	-19.12	-15.82	
VV	-19.90	-17.30	-16.50	-12.02	-11.31	-7.87	-0.52
ANGLE=70 DEGREES			RANGE= 54.29 (m)			TIME=1338	
HH	-28.30	-23.80	-20.90	-15.32	-13.60	-10.54	-5.58
HV	-34.10	-29.00	-23.40	-21.35	-22.30	-18.52	
VV	-27.20	-23.90		-14.11	-13.87	-11.17	-3.50

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/18/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.45 (m)	TIME=1417			
HH	11.70	10.40	10.50	10.70	9.71	8.31	2.10
HV		-5.00		3.37	2.11	0.77	
VV	12.20	10.80	11.30	14.95	11.53	10.71	1.29
ANGLE=20 DEGREES			RANGE= 19.87 (m)	TIME=1446			
HH	-4.30	-5.80	-6.40	-6.90	-7.86	-7.23	-2.62
HV	-8.30	-16.50	-15.30	-14.33	-13.66	-13.45	
VV	-4.30	-5.80	-6.50	-3.31	-3.88	-4.82	-3.35
ANGLE=50 DEGREES			RANGE= 28.67 (m)	TIME=1502			
HH	-20.30	-17.60	-16.10	-15.22	-14.06	-11.09	-4.87
HV	-27.40	-24.00	-21.00	-18.99	-20.74	-19.13	
VV	-19.90	-17.60	-15.00	-12.23	-12.01	-10.64	-5.51
ANGLE=70 DEGREES			RANGE= 54.29 (m)	TIME=1517			
HH	-26.60	-23.80	-20.20	-17.66	-16.75	-13.50	-8.33
HV	-33.30	-29.00	-23.80	-22.84	-24.73	-21.64	
VV	-26.20	-23.60		-16.06	-16.27	-14.38	-7.13

DATE: 1/18/80

ANGLE= 0 DEGREES			RANGE= 18.26 (m)	TIME=1532			
HH	11.00	10.80	12.10	11.19	10.45	8.08	1.38
HV		-6.30		2.00	1.94	13.59	
VV	11.50	11.10	12.60	13.81	12.95	10.45	0.44
ANGLE=20 DEGREES			RANGE= 19.64 (m)	TIME=1603			
HH	-6.80	-7.40	-6.30	-8.97	-6.53	-6.67	-1.38
HV	-19.50	-18.10	-12.70	-14.48	-13.12	-12.47	
VV	-7.30	-7.70	-5.80	-5.42	-4.10	-3.53	-1.65
ANGLE=50 DEGREES			RANGE= 28.56 (m)	TIME=1625			
HH	-19.40	-16.80	-13.90	-16.26	-13.01	-9.87	-1.13
HV	-25.70	-24.40	-20.40	-18.87	-19.79	-17.53	
VV	-19.40	-16.90	-13.30	-11.66	-10.84	-8.28	-1.69
ANGLE=70 DEGREES			RANGE= 52.83 (m)	TIME=1637			
HH	-26.50	-24.00	-19.30	-17.08	-14.91	-11.52	-4.97
HV	-33.30	-28.80	-23.20	-21.21	-22.09	-19.24	
VV	-25.50	-23.20		-14.95	-14.15	-11.69	-3.78

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/19/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 19.01 (m)			TIME= 837	
HH	9.70	9.10	11.60	7.98	8.51	6.69	3.43
HV		-8.30		1.26	0.61	-2.67	
VV	10.10	9.20	11.90	10.34	10.50	8.91	2.62
ANGLE=20 DEGREES			RANGE= 20.21 (m)			TIME= 906	
HH	-9.10	-9.60	-7.30	-4.96	-6.04	-5.19	1.86
HV	-20.60	-18.10	-14.60	-9.51	-13.88	-12.47	
VV	-10.10	-9.80	-7.20	-2.43	-3.58	-2.87	1.44
ANGLE=50 DEGREES			RANGE= 28.89 (m)			TIME= 925	
HH	-18.90	-17.80	-13.80	-11.97	-11.74	-8.80	-0.10
HV	-25.40	-24.00	-19.30	-16.25	-18.27	-14.76	
VV	-19.50	-18.60	-14.10	-10.43	-9.81	-6.88	1.30
ANGLE=70 DEGREES			RANGE= 53.19 (m)			TIME= 936	
HH	-29.30	-25.30	-21.40	-14.30	-13.27	-9.41	-3.62
HV	-35.70	-30.10	-24.80	-19.26	-20.41	-17.33	
VV	-28.30	-25.00		-13.87	-13.02	-10.11	-2.40

DATE: 1/19/80

ANGLE= 0 DEGREES			RANGE= 18.85 (m)			TIME= 950	
HH	9.60	10.00	11.10	12.10	11.53	11.09	3.77
HV		-6.90		6.09	5.49	2.84	
VV	9.70	9.90	10.80	13.81	13.97	12.97	2.50
ANGLE=20 DEGREES			RANGE= 20.26 (m)			TIME=1013	
HH	-6.70	-9.40	-9.00	-5.08	-2.81	-4.01	1.53
HV	-18.40	-18.30	-15.50	-8.41	-11.17	-10.21	
VV	-7.50	-9.80	-9.70	-2.48	-0.66	-1.55	1.43
ANGLE=50 DEGREES			RANGE= 28.78 (m)			TIME=1030	
HH	-19.20	-18.30	-13.20	-11.82	-9.98	-7.66	0.26
HV	-25.90	-24.40	-20.90	-16.57	-17.62	-14.51	
VV	-19.30	-17.60	-14.30	-10.95	-8.61	-6.33	0.95
ANGLE=70 DEGREES			RANGE= 51.79 (m)			TIME=1041	
HH	-27.90	-24.00	-21.10	-14.42	-13.16	-9.11	-3.41
HV	-35.40	-29.10	-23.80	-18.99	-19.83	-17.22	
VV	-26.90	-24.00		-14.16	-12.29	-10.32	-2.18

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/19/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE=	18.60 (m)	TIME=1055		
HH	10.50	9.30	9.80	11.83	10.59	10.59	4.62
HV		-8.30		5.12	4.81	0.37	
VV	10.80	9.20	10.00	13.63	13.71	12.47	3.47
ANGLE=20 DEGREES			RANGE=	20.15 (m)	TIME=1118		
HH	-8.00	-7.40	-7.00	-4.15	-4.54	-3.72	1.68
HV	-20.20	-17.30	-14.20	-9.43	-11.59	-10.11	
VV	-8.90	-7.90	-6.20	-1.42	-1.84	-1.67	1.17
ANGLE=50 DEGREES			RANGE=	29.01 (m)	TIME=1137		
HH		-19.00	-15.70	-13.29	-11.20	-6.95	0.93
HV	-29.50	-27.10	-21.20	-17.95	-18.31	-14.45	
VV	-20.40	-18.50	-15.10	-10.79	-9.50	-6.80	1.41
ANGLE=70 DEGREES			RANGE=	51.45 (m)	TIME=1152		
HH	-26.10	-23.70	-20.20	-14.66	-13.19	-10.03	-3.67
HV	-34.00	-29.30	-23.20	-19.59	-20.31	-18.20	
VV	-26.00	-23.70		-13.48	-12.76	-10.21	-2.80

DATE: 1/19/80

ANGLE= 0 DEGREES			RANGE=	18.60 (m)	TIME=1205		
HH	8.30	6.60	8.90	8.78	9.90	8.14	2.86
HV		-9.30		3.26	1.91	-0.78	
VV	8.20	6.10	9.00	10.52	12.84	11.00	1.95
ANGLE=20 DEGREES			RANGE=	20.09 (m)	TIME=1242		
HH	-7.70	-7.80	-6.90	-5.84	-5.15	-3.82	0.44
HV	-18.50	-18.20	-14.10	-8.65	-11.54	-10.28	
VV	-8.40	-8.50	-5.90	-3.24	-2.71	-2.28	-0.59
ANGLE=50 DEGREES			RANGE=	28.67 (m)	TIME=1258		
HH	-18.90	-17.70	-14.00	-12.76	-9.97	-9.34	-0.65
HV	-25.20	-23.50	-19.60	-15.86	-16.64	-14.73	
VV	-19.00	-17.90	-13.20	-10.09	-9.91	-7.44	-0.23
ANGLE=70 DEGREES			RANGE=	52.13 (m)	TIME=1308		
HH	-25.80	-23.30	-19.60	-14.17	-13.39	-10.65	-4.8
HV	-33.70	-29.80	-25.30	-20.62	-21.57	-18.73	
VV	-26.50	-23.20		-13.91	-13.52	-11.73	-3.80

STEAMBOAT SPRINGS, COLORADO 1980
 SCATTERING COEFFICIENT σ^0 (dB)
 TEST SITE # 1, HIBBERT

DATE: 1/19/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE=50 DEGREES RANGE= 28.45 (m) TIME=1354
 HH -19.80 -18.00 -13.40 -12.96 -11.18 -8.23 -1.45
 HV -25.20 -23.70 -21.10 -17.36 -17.28 -15.45
 VV -19.80 -17.50 -12.40 -9.51 -9.38 -7.18 -0.47

DATE: 1/19/80

ANGLE=50 DEGREES RANGE= 28.78 (m) TIME=1410
 HH -18.70 -17.60 -13.00 -12.66 -11.61 -7.84 -0.61
 HV -25.10 -23.70 -18.90 -17.45 -17.35 -15.47
 VV -18.60 -17.70 -13.40 -10.07 -9.45 -7.97 -1.06

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 3, RABBIT EAR'S PASS

DATE: 1/21/80

FREQUENCY (GHZ)
1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 18.20 (m) TIME=1330

HH 2.00 6.00 10.50

HV

VV 1.10 5.80 10.40

ANGLE=20 DEGREES RANGE= 20.10 (m)

HH -14.20 -13.60

HV -26.80 -24.10

VV -12.20 -14.50

ANGLE=50 DEGREES RANGE= 28.20 (m)

HH -20.30 -18.20

HV -31.20 -31.90 -27.80

VV -19.80 -18.40

ANGLE=70 DEGREES RANGE= 55.40 (m)

HH -23.80 -23.20 -22.20

HV -34.30 -33.70 -31.90

VV -23.00 -23.10

DATE: 1/21/80

ANGLE= 0 DEGREES RANGE= 18.65 (m) TIME=1420
HH 9.52 9.39 11.01 3.68
HV 1.70 3.34 3.93
VV 13.27 14.40 16.24 2.75

ANGLE=20 DEGREES RANGE= 20.56 (m) TIME=1446
HH -10.22 -11.60 -7.83 -0.82
HV -16.18 -16.07 -13.14
VV -7.97 -8.58 -5.67 -1.03

ANGLE=50 DEGREES RANGE= 29.35 (m) TIME=1510
HH -12.41 -13.48 -9.01 -2.25
HV -17.91 -20.75 -16.33
VV -10.21 -10.76 -7.05 -1.89

ANGLE=70 DEGREES RANGE= 52.92 (m) TIME=1524
HH -18.57 -18.31 -15.33 -6.60
HV -24.44 -24.27 -20.58
VV -18.17 -16.10 -12.08 -5.83

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 3, RABBIT EAR'S PASS

DATE: 1/21/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.41 (m)		TIME=1543		
HH	1.40	6.30	11.40	11.41	12.71	15.75	3.74
HV				2.22	2.80		
VV	0.70	6.20	11.30	14.05	15.77	18.71	2.63
ANGLE=20 DEGREES			RANGE= 20.32 (m)		TIME=1613		
HH		-12.60	-13.10	-9.23	-12.77	-7.71	-2.47
HV		-25.30		-14.80	-17.09	-15.77	
VV	-12.10	-12.50	-12.90	-7.16	-8.45	-5.44	-1.22
ANGLE=50 DEGREES			RANGE= 29.23 (m)		TIME=1630		
HH		-20.70	-18.50	-15.96	-14.82	-10.38	-2.55
HV	-32.70	-31.40		-21.90	-22.08	-18.44	
VV		-20.30	-17.30	-13.71	-12.35	-7.37	-0.92
ANGLE=70 DEGREES			RANGE= 53.92 (m)		TIME=1650		
HH	-27.10	-22.30	-24.70	-18.78	-18.87	-16.26	-6.58
HV	-39.30	-36.70	-33.40	-24.90	-25.56	-22.12	
VV	-29.00	-26.50		-18.36	-16.25	-12.92	-5.13

DATE: 1/21/80

ANGLE= 0 DEGREES			RANGE= 18.49 (m)		TIME=1658		
HH	1.10	6.00	10.40	9.14	10.00	13.63	3.73
HV				0.39	2.04	2.79	
VV	0.90	6.40	11.10	12.31	14.80	17.74	2.57
ANGLE=20 DEGREES			RANGE= 20.06 (m)		TIME=1715		
HH		-15.00	-13.90	-10.10	-11.54	-7.70	-1.78
HV		-26.20	-22.70	-15.66	-16.82	-14.72	
VV		-14.90		-7.31	-8.87	-5.41	-1.45
ANGLE=50 DEGREES			RANGE= 28.90 (m)		TIME=1728		
HH		-19.30	-16.20	-14.59	-13.74	-9.18	-2.48
HV	-30.10	-29.40	-25.40	-19.49	-21.04	-17.13	
VV	-19.70	-19.00	-16.60	-12.45	-10.53	-6.70	-1.42
ANGLE=70 DEGREES			RANGE= 52.73 (m)		TIME=1742		
HH	-28.20	-25.70	-24.30	-18.51	-18.76	-15.51	-6.93
HV	-36.20	-35.70	-32.50	-25.51	-25.84	-21.46	
VV	-28.10	-25.70		-17.39	-15.57	-12.47	-5.85

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/22/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE=	18.31 (m)	TIME=1107		
HH	11.00	10.30	12.20	10.10	11.12	9.41	2.68
HV		-6.30		3.99	2.02	0.82	
VV	10.40	10.20	12.50	13.44	13.72	12.69	2.09
ANGLE=20 DEGREES			RANGE=	19.54 (m)	TIME=1135		
HH		-11.20	-7.80	-4.67	-4.13	-2.13	1.08
HV	-20.30	-19.50	-15.90	-10.19	-13.01	-9.49	
VV	-9.80	-10.20	-8.90	-3.59	-1.36	-0.19	0.63
ANGLE=50 DEGREES			RANGE=	28.27 (m)	TIME=1148		
HH	-21.80	-18.60	-16.60	-13.66	-10.04	-7.40	-0.21
HV	-27.20	-25.20	-20.80	-17.22	-17.06	-14.05	
VV	-20.70	-19.90	-17.20	-11.13	-9.25	-5.70	0.21
ANGLE=70 DEGREES			RANGE=	53.03 (m)	TIME=1238		
HH	-30.00	-25.80	-22.20	-16.80	-12.85	-8.40	-2.45
HV	-37.40	-32.20	-27.00	-21.45	-21.00	-16.19	
VV	-29.60	-25.90		-15.32	-11.86	-9.25	-3.08

DATE: 1/22/80

ANGLE= 0 DEGREES			RANGE=	17.90 (m)	TIME=1225		
HH	11.30	11.70	14.10				
HV		-5.20					
VV	11.50	11.80	15.10				
ANGLE=20 DEGREES			RANGE=	19.50 (m)			
HH		-9.10	-8.00				
HV	-21.20	-19.20	-13.80				
VV	-10.10	-9.90	-7.60				
ANGLE=50 DEGREES			RANGE=	28.90 (m)			
HH		-18.40	-16.40				
HV	-27.90	-27.10	-20.60				
VV		-18.50	-16.50				
ANGLE=70 DEGREES			RANGE=	53.60 (m)			
HH	-29.70	-25.90	-22.40				
HV	-37.50	-32.30	-26.50				
VV	-29.20	-25.40					

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/22/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.28 (m)	TIME=1320			
HH	11.10	11.20	13.00	11.37	12.72	11.78	1.82
HV		-5.70		5.24	3.94	4.99	
VV	11.20	11.20	14.50	15.87	16.09	13.96	0.81
ANGLE=20 DEGREES			RANGE= 19.82 (m)	TIME=1337			
HH		-9.20	-6.60	-5.44	-5.01	-4.37	-0.83
HV	-20.10	-18.30	-14.40	-10.80	-12.22	-9.96	
VV	-9.80	-8.60	-7.50	-2.31	-1.64	-2.06	-1.40
ANGLE=50 DEGREES			RANGE= 28.46 (m)	TIME=1355			
HH		-19.90	-15.00	-14.32	-10.77	-6.86	0.38
HV	-27.90	-26.50	-21.80	-17.61	-18.44	-15.64	
VV	-21.20	-19.60	-15.70	-10.17	-8.58	-6.34	-0.23
ANGLE=70 DEGREES			RANGE= 54.70 (m)	TIME=1404			
HH	-29.30	-25.90	-22.70	-16.11	-12.14	-8.89	-2.47
HV	-37.60	-32.80	-28.50	-22.07	-20.75	-16.96	
VV	-29.70	-26.10		-14.83	-12.80	-9.91	-2.46

DATE: 1/22/80

ANGLE= 0 DEGREES			RANGE= 18.40 (m)	TIME=1420			
HH	12.70	13.10	15.40	9.49	13.02	13.52	1.33
HV		-5.00		2.37	4.77	4.53	
VV	13.00	13.10	16.60	15.43	16.61	16.87	0.24
ANGLE=20 DEGREES			RANGE= 19.98 (m)	TIME=1440			
HH		-8.60	-9.40	-8.48	-6.13	-3.68	-0.73
HV	-20.30	-18.50	-13.80	-11.97	-12.86	-10.22	
VV	-11.90	-9.30	-8.50	-3.56	-4.17	-1.11	-2.40
ANGLE=50 DEGREES			RANGE= 28.35 (m)	TIME=1452			
HH		-19.40	-15.40	-13.56	-10.81	-7.41	0.45
HV	-28.90	-25.30	-19.30	-17.40	-17.91	-14.41	
VV	-21.50	-18.60	-15.90	-10.32	-8.51	-6.86	-0.52
ANGLE=70 DEGREES			RANGE= 51.96 (m)	TIME=1501			
HH	-29.30	-25.30	-21.00	-16.14	-13.10	-11.00	-7.33
HV	-36.50	-31.50	-25.70	-21.03	-21.40	-17.74	
VV	-28.70	-24.60		-13.55	-13.30	-10.48	-2.97

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/22/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE=50	DEGREES	RANGE=	28.71 (m)	TIME=1530	
HH			-11.28	-10.14	-7.04 0.52
HV			-17.02	-18.29	-14.26
VV			-10.61	-8.60	-5.03 0.87
ANGLE=55	DEGREES	RANGE=	31.31 (m)	TIME=1534	
HH			-11.43	-11.48	-7.87 0.74
HV			-16.98	-17.85	-15.46
VV			-11.32	-10.32	-5.79 0.32
ANGLE=60	DEGREES	RANGE=	36.02 (m)	TIME=1539	
HH			-13.03	-12.27	-8.26 -0.90
HV			-17.56	-19.26	-16.06
VV			-12.94	-10.48	-7.40 -0.92
ANGLE=65	DEGREES	RANGE=	43.09 (m)	TIME=1543	
HH			-13.40	-12.30	-8.86 -0.87
HV			-19.88	-20.43	-16.06
VV			-13.07	-11.45	-8.14 -2.03

DATE: 1/24/80

ANGLE= 0	DEGREES	RANGE=	13.30 (m)	TIME=1040
HH	3.60 2.90		7.50	
HV			-14.40	
VV	3.60 2.70		8.10	
ANGLE=20	DEGREES	RANGE=	19.80 (m)	
HH			-11.40 -11.70	
HV			-25.50 -19.70	
VV	-12.20 -11.70		-11.00	
ANGLE=50	DEGREES	RANGE=	29.10 (m)	
HH			-21.00 -16.90	
HV			-32.60 -26.50	
VV	-20.90 -20.60		-16.80	
ANGLE=70	DEGREES	RANGE=	55.00 (m)	
HH	-30.20 -27.10		-23.70	
HV			-38.00 -31.70	
VV	-28.30 -26.90			

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/24/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 18.40 (m) TIME=1155

HH 5.30 5.30 9.40

HV

VV 5.30 5.20 9.70

ANGLE=20 DEGREES RANGE= 19.70 (m)

HH -11.90 -8.20

HV -24.00 -18.60

VV -10.30 -12.60 -8.10

ANGLE=50 DEGREES RANGE= 29.30 (m)

HH -21.70 -16.30

HV -35.90 -30.70 -26.60

VV -21.10 -15.90

ANGLE=70 DEGREES RANGE= 54.80 (m)

HH -29.90 -27.80 -22.10

HV -37.40 -30.80

VV -29.40 -27 0

DATE: 1/24/80

ANGLE=20 DEGREES RANGE= 20.13 (m) TIME=1228
HH -6.63 -5.73 -2.79 0.59
HV -11.60 -12.44 -10.09
VV -1.99 -3.10 -0.95 1.00

ANGLE=50 DEGREES RANGE= 29.29 (m) TIME=1248
HH -14.25 -11.13 -7.00 -0.70
HV -18.40 -18.16 -13.57
VV -11.40 -9.69 -6.36 -0.67

ANGLE=70 DEGREES RANGE= 54.76 (m) TIME=1300
HH -15.20 -12.78 -9.77 -3.40
HV -21.44 -20.88 -17.50
VV -15.06 -13.07 -10.07 -3.44

STEAMBOAT SPRINGS, COLORADO 1980
 SCATTERING COEFFICIENT σ^0 (dB)
 TEST SITE # 1, HIBBERT

DATE: 1/24/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE=50 DEGREES RANGE= 29.60 (m) TIME=1325

HH -19.00 -19.50 -14.80

HV -31.70

VV -19.80 -19.50 -14.60

DATE: 1/24/80

ANGLE=50 DEGREES RANGE= 29.31 (m) TIME=1340

HH -21.10 -20.00 -15.30 -14.35 -11.63 -7.46 0.02

HV -32.80 -26.20 -18.35 -17.75 -14.41

VV -20.40 -19.40 -15.30 -11.90 -9.17 -6.60 -0.05

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 2 BAR LAZY -L

DATE: 1/25/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.70 (m)			TIME=1046	
HH	3.70	1.50	6.60	3.12	3.07	4.10	2.39
HV		-13.30		-1.87	-5.79	-3.40	
VV	4.60	1.90	6.40	7.00	6.26	6.90	2.04
ANGLE=20 DEGREES			RANGE= 19.81 (m)			TIME=1106	
HH	-5.10	-8.80	-7.00	-7.19	-6.26	-4.44	0.49
HV		-20.90	-15.80	-12.79	-13.29	-11.91	
VV	-6.00	-8.90	-6.30	-4.52	-3.04	-2.14	-0.90
ANGLE=50 DEGREES			RANGE= 26.80 (m)			TIME=1121	
HH		-20.50	-16.00	-16.30	-12.74	-7.78	0.11
HV	-29.70	-28.90		-19.91	-19.65	-15.47	
VV		-21.10	-16.40	-13.03	-10.74	-6.72	-0.28
ANGLE=70 DEGREES			RANGE= 42.01 (m)			TIME=1134	
HH	-29.20	-26.00	-23.10	-14.93	-12.81	-8.86	-2.34
HV	-36.40	-32.40	-27.80	-20.71	-20.36		
VV	-27.00	-25.10	-22.90	-14.45	-12.42	-8.75	-2.04

DATE: 1/25/80

ANGLE= 0 DEGREES			RANGE= 18.32 (m)			TIME=1221	
HH	5.60	1.60	5.80	5.58	5.77	5.40	3.33
HV		-16.20		-0.16	-1.49	-1.33	
VV	6.40	2.00	5.80	9.21	10.13	8.88	2.69
ANGLE=20 DEGREES			RANGE= 19.60 (m)			TIME=1242	
HH	-5.60	-8.70	-5.90	-5.33	-5.03	-2.71	1.17
HV		-22.20		-11.77	-13.99	-10.87	
VV	-6.00	-9.30	-5.20	-3.65	-1.51	0.75	0.43
ANGLE=50 DEGREES			RANGE= 26.76 (m)			TIME=1304	
HH		-19.60	-18.40	-14.88	-12.34	-7.98	0.28
HV		-32.70		-20.30	-19.26	-14.70	
VV		-19.70	-18.40	-12.61	-10.89	-5.63	0.13
ANGLE=70 DEGREES			RANGE= 43.72 (m)			TIME=1318	
HH	-29.00	-25.90	-22.10	-14.41	-12.93	-9.31	-2.23
HV		-36.60		-20.35	-20.87	-16.18	
VV	-27.50	-25.60	-23.50	-14.72	-12.21	-9.53	-2.11

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 2, BAR LAZY -L

DATE: 1/25/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES							
RANGE=			18.49 (m)				
TIME=1337							
HH	4.50	2.20	9.40	3.51	5.03	8.16	1.75
HV		-15.10		-1.78	-2.61	-2.50	
VV	5.30	1.80	9.30	7.17	8.76	10.19	1.29
ANGLE=20 DEGREES							
RANGE=			19.20 (m)				
HH	-5.20	-8.60	-4.60				
HV		-21.30					
VV	-5.90	-8.40	-4.10				
ANGLE=50 DEGREES							
RANGE=			27.10 (m)				
HH		-19.20	-16.50				
HV		-33.00					
VV		-20.00	-16.30				
ANGLE=70 DEGREES							
RANGE=			44.50 (m)				
HH	-28.40	-25.70	-22.40				
HV		-36.20					
VV	-27.20	-25.40	-22.20				

DATE: 1/25/80

ANGLE=50 DEGREES							
RANGE=			26.23 (m)				
TIME=1420							
HH			-16.11	-11.83	-7.44		0.19
HV			-20.31	-20.04	-14.56		
VV			-13.17	-11.00	-5.73		0.64
ANGLE=70 DEGREES							
RANGE=			41.97 (m)				
TIME=1430							
HH			-16.80	-13.48	-9.18		-2.69
HV			-22.35	-21.51	-16.34		
VV			-15.67	-12.02	-9.55		-1.91

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 2, BAR LAZY -L

DATE: 1/25/80

FREQUENCY (GHZ)	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE=	18.44 (m)	TIME=1443		
HH	4.60	3.50	9.00	5.69	5.30	5.18	1.58
HV				-0.08	-1.42	-0.80	
VV	5.00	3.10	9.20	8.71	9.35	8.66	1.80
ANGLE=20 DEGREES			RANGE=	19.78 (m)	TIME=1505		
HH	-4.80	-7.50	-5.80	-5.37	-6.47	-5.15	0.95
HV		-23.90		-12.22	-12.88	-11.05	
VV	-5.30	-7.40	-5.10	-3.28	-3.71	-1.14	0.14
ANGLE=50 DEGREES			RANGE=	25.78 (m)	TIME=1520		
HH		-19.80	-16.20	-14.02	-11.92	-7.62	0.57
HV	-35.30	-32.20		-18.90	-18.90	-14.22	
VV		-19.40	-16.20	-12.56	-10.35	-6.29	0.58
ANGLE=70 DEGREES			RANGE=	42.95 (m)	TIME=1540		
HH	-27.90	-26.10	-21.90	-15.18	-13.11	-9.41	-2.42
HV		-37.50		-20.93	-21.64	-17.09	
VV	-26.40	-25.40	-22.70	-16.28	-13.31	-9.13	-2.23

DATE: 1/25/80

ANGLE=50 DEGREES			RANGE=	25.47 (m)	TIME=1555		
HH		-19.00	-15.50	-13.38	-11.63	-8.78	0.32
HV	-35.20	-31.30		-19.14	-18.78	-15.14	
VV		-18.70	-17.20	-13.01	-10.16	-5.86	0.13

DATE: 1/25/80

ANGLE=50 DEGREES			RANGE=	26.54 (m)	TIME=1613		
HH		-19.10	-14.20	-14.62	-11.72	-7.48	0.15
HV	-33.30	-30.70		-20.09	-19.25	-14.80	
VV		-19.40	-14.70	-12.76	-10.26	-5.15	0.47

DATE: 1/25/80

ANGLE=50 DEGREES			RANGE=	25.78 (m)	TIME=1620		
HH		-19.70	-14.10	-14.18	-11.86	-7.50	0.84
HV	-29.50	-28.00		-20.01	-19.01	-15.32	
VV		-19.60	-15.50	-13.18	-9.87	-5.79	0.38

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/26/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE=	18.70 (m)	TIME=1030		
HH	3.90	3.50	5.10	7.17	7.55	9.23	1.93
HV		-11.30		0.46	-0.23	-0.78	
VV	3.50	3.30	5.90	10.20	9.94	10.67	1.57
ANGLE=20 DEGREES			RANGE=	20.39 (m)	TIME=1100		
HH		-10.00	-9.30	-7.46	-7.72	-3.56	0.08
HV		-22.60		-11.39	-13.29	-9.80	
VV	-10.40	-10.40	-9.10	-3.71	-4.67	-1.01	0.21
ANGLE=50 DEGREES			RANGE=	28.76 (m)	TIME=1115		
HH	-19.80	-18.90	-15.90	-13.12	-10.99	-6.50	0.03
HV		-31.50		-17.66	-16.85	-14.06	
VV	-19.20	-18.70	-16.30	-12.39	-10.16	-6.65	1.01
ANGLE=70 DEGREES			RANGE=	53.01 (m)	TIME=1127		
HH	-30.20	-28.50	-22.70	-15.11	-12.63	-9.33	-3.24
HV		-38.60	-31.40	-21.51	-21.19	-17.26	
VV	-27.70	-25.80		-15.72	-13.57	-9.16	-3.13

DATE: 1/26/80

ANGLE= 0 DEGREES			RANGE=	18.52 (m)	TIME=1143		
HH	6.00	6.90	6.90	10.11	10.38	9.90	2.88
HV				3.27	1.44	0.78	
VV	5.80	6.70	7.50	13.16	12.93	11.47	2.10
ANGLE=20 DEGREES			RANGE=	20.18 (m)	TIME=1203		
HH		-9.80	-7.80	-7.88	-6.28	-3.85	0.40
HV		-22.70	-17.30	-12.52	-13.42	-8.90	
VV	-10.30	-10.50	-7.60	-2.87	-2.74	-0.74	-0.05
ANGLE=50 DEGREES			RANGE=	29.06 (m)	TIME=1225		
HH	-19.00	-18.30	-14.30	-14.19	-10.73	-6.98	-0.43
HV		-29.70	-24.90	-17.07	-16.82	-13.29	
VV	-20.20	-18.50	-14.30	-11.53	-9.60	-5.17	0.19
ANGLE=70 DEGREES			RANGE=	53.37 (m)	TIME=1240		
HH	-30.10	-27.40	-22.80	-14.79	-12.59	-9.92	-3.02
HV		-40.00		-21.20	-20.70	-16.60	
VV	-27.80	-25.70		-15.28	-12.70	-9.56	-3.09

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/26/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.49 (m)	TIME=1300			
HH	6.70	7.80	9.90	11.74	10.78	8.92	2.85
HV				7.39	2.29	2.36	
VV	6.80	7.60	10.30	14.45	14.18	11.95	2.47
ANGLE=20 DEGREES			RANGE= 19.91 (m)	TIME=1325			
HH	-7.50	-9.50	-7.60	-3.39	-6.66	-4.01	0.65
HV		-24.70		-9.94	-12.42	-9.65	
VV	-8.90	-10.00	-6.70	-1.02	-2.85	-1.37	1.10
ANGLE=50 DEGREES			RANGE= 29.06 (m)	TIME=1345			
HH		-20.10	-16.60	-13.07	-10.83	-7.62	-0.24
HV		-32.10	-27.00	-16.97	-17.50	-13.46	
VV	-20.30	-20.30	-16.40	-12.50	-9.19	-4.88	0.42
ANGLE=70 DEGREES			RANGE= 53.62 (m)	TIME=1358			
HH	-29.90	-27.70	-22.20	-15.12	-12.14	-9.43	-3.07
HV		-39.60	-32.10	-21.33	-20.43	-16.31	
VV	-28.70	-26.40		-15.81	-12.43	-7.54	-1.91

DATE: 1/26/80

ANGLE= 0 DEGREES			RANGE= 18.66 (m)	TIME=1415			
HH	7.10	7.60	8.10	9.51	8.84	8.53	3.27
HV				3.74	1.03	1.04	
VV	6.60	7.30	8.80	12.31	12.35	12.22	2.77
ANGLE=20 DEGREES			RANGE= 19.93 (m)	TIME=1445			
HH		-9.30	-7.20	-4.61	-6.45	-4.96	0.81
HV		-22.50		-10.14	-12.01	-9.05	
VV	-9.90	-9.70	-7.20	-2.48	-3.28	0.30	1.00
ANGLE=50 DEGREES			RANGE= 29.01 (m)	TIME=1505			
HH		-20.00	-14.60	-14.03	-11.55	-7.25	0.18
HV		-33.00		-17.82	-17.32	-14.07	
VV	-20.80	-20.40	-15.80	-13.38	-10.54	-4.63	0.42
ANGLE=70 DEGREES			RANGE= 52.30 (m)	TIME=1520			
HH	-29.20	-27.20	-21.30	-15.32	-12.49	-9.64	-2.63
HV		-38.40	-31.50	-21.63	-21.21	-17.11	
VV	-28.30	-26.30		-15.97	-12.14	-8.44	-2.53

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/26/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE=50 DEGREES			RANGE= 28.83 (m)		TIME=1540		
HH	-19.60		-13.90	-13.06	-11.12	-6.40	-0.33
HV	-31.50			-17.33	-17.83	-13.06	
VV -19.70	-19.60		-14.60	-12.43	-9.52	-4.98	0.49
ANGLE=55 DEGREES			RANGE= 31.73 (m)		TIME=1550		
HH -22.50	-21.70		-18.60	-13.34	-10.39	-8.14	-0.60
HV	-32.40		-27.90	-17.49	-18.87	-14.89	
VV -22.80	-21.90		-17.50	-11.75	-9.11	-4.88	0.27
ANGLE=60 DEGREES			RANGE= 36.71 (m)		TIME=1558		
HH -25.50	-22.50		-17.20	-14.33	-11.11	-8.11	-0.18
HV	-35.00			-19.50	-19.61	-15.16	
VV -24.00	-22.20		-18.80	-13.00	-9.86	-6.10	0.09
ANGLE=65 DEGREES			RANGE= 43.19 (m)		TIME=1605		
HH -27.70	-24.10		-19.30	-14.07	-12.68	-7.66	-1.58
HV	-33.00		-25.90	-19.06	-20.09	-14.62	
VV -26.50	-24.70		-19.90	-14.44	-11.79	-7.23	-1.86
ANGLE=70 DEGREES			RANGE= 51.79 (m)		TIME=1615		
HH -29.50	-27.00		-21.50	-15.18	-12.70	-8.81	-3.14
HV	-38.60		-30.50	-21.19	-21.20	-16.85	
VV -28.80	-26.80			-15.38	-12.06	-8.15	-2.06
ANGLE=75 DEGREES			RANGE= 66.50 (m)		TIME=1622		
HH -31.50	-30.50		-24.10	-15.00	-12.95	-10.87	-4.71
HV -42.30	-39.50		-32.90	-22.19	-22.42	-18.54	
VV -31.30	-28.70			-16.08	-14.40	-10.84	-4.59
ANGLE=80 DEGREES			RANGE= 96.28 (m)		TIME=1628		
HH -33.10	-33.40		-26.50	-16.10	-14.39	-13.54	-5.07
HV -45.60	-43.20			-25.05	-23.77	-22.12	
VV -34.80	-33.40		-23.00	-19.39	-17.43	-14.53	-6.07
ANGLE=85 DEGREES			RANGE= 169.97 (m)		TIME=1635		
HH				-20.71	-18.49	-19.22	-9.27
HV				-29.70	-28.42	-27.81	
VV				-24.19	-22.31	-20.63	-9.30

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 2, BAR LAZY -L

DATE: 1/27/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 4 DEGREES			RANGE=	18.53 (m)	TIME=1036		
HH	2.75	3.50	-2.00	2.74	1.89	1.75	1.47
HV				-3.50	-5.60	-6.24	
VV	2.75	-3.00	7.50	4.15	5.75	5.29	1.30
ANGLE=16 DEGREES			RANGE=	19.11 (m)	TIME=1115		
HH	-6.50	-9.75	-10.00		-6.33	-3.82	0.31
HV		-21.00	-18.50	-14.86	-13.89	-11.57	
VV	-7.50	-9.50	-9.00	-5.65	-4.53	-2.47	0.46
ANGLE=46 DEGREES			RANGE=	26.78 (m)	TIME=1143		
HH		-20.50	-18.50	-17.19	-12.68	-7.19	-0.47
HV	-29.50	-29.50	-29.00	-21.00	-19.99	-13.83	
VV		-19.80	-18.00	-14.38	-10.07	-5.70	-0.05
ANGLE=66 DEGREES			RANGE=	43.94 (m)	TIME=1200		
HH	-29.00	-26.50	-23.00	-16.36	-13.46	-8.37	-3.45
HV	-37.50	-34.50	-28.00	-22.11	-21.71	-16.73	
VV	-28.50	-26.50	-24.00	-15.32	-12.73	-8.64	-3.15

DATE: 1/27/80

ANGLE= 0 DEGREES			RANGE=	18.21 (m)	TIME=1225		
HH	5.30	5.20	8.60	4.91	5.73	7.37	2.62
HV				-0.11	-2.48	0.56	
VV	5.30	5.40	9.60	8.46	9.60	9.77	1.75
ANGLE=20 DEGREES			RANGE=	19.73 (m)	TIME=1255		
HH		-10.40	-10.80	-9.69	-8.20	-4.52	0.53
HV	-23.50	-24.20	-20.10	-15.39	-14.22	-10.89	
VV	-10.20	-10.30	-10.50	-5.84	-4.51	-1.80	0.11
ANGLE=50 DEGREES			RANGE=	28.06 (m)	TIME=1315		
HH		-21.70	-18.30	-16.36	-12.14	-7.72	-0.10
HV	-34.20	-31.40	-27.30	-20.99	-19.82	-14.40	
VV		-21.00	-19.40	-13.63	-10.38	-5.62	-0.27
ANGLE=70 DEGREES			RANGE=	52.51 (m)	TIME=1325		
HH	-30.30	-27.70	-24.40	-17.68	-13.23	-8.51	-3.69
HV	-38.90	-36.30	-29.70	-23.97	-21.82	-15.87	
VV	-28.00	-27.10		-17.08	-13.25	-8.10	-4.06

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 2, BAR LAZY -L

DATE: 1/27/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 18.26 (m) TIME=1338
HH 11.70 16.40 16.60 4.49 7.48 9.16 2.13
HV -0.96 -0.68 1.08
VV 12.40 16.70 17.30 9.70 10.23 12.46 1.45

ANGLE=20 DEGREES RANGE= 18.60 (m)
HH -12.00 -9.60
HV -27.10
VV -11.30 -11.90

ANGLE=50 DEGREES RANGE= 27.92 (m) TIME=1450
HH -20.00 -17.00 -15.61 -12.16 -7.18 -0.41
HV -34.00 -21.09 -19.78 -13.16
VV -20.70 -18.00 -14.61 -11.00 -5.65 0.45

ANGLE=70 DEGREES RANGE= 51.25 (m) TIME=1500
HH -30.10 -26.80 -23.20 -18.43 -13.38 -10.06 -3.58
HV -38.30 -31.80 -23.40 -21.26 -17.03
VV -29.20 -26.70 -15.96 -12.34 -9.19 -3.64

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/29/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.62 (m)	TIME=1038			
HH	10.40	11.00	12.20	11.57	8.25	6.80	2.68
HV		-6.60			-0.87	-1.81	
VV	10.50	11.10	12.60	14.01	11.16	9.69	1.66
ANGLE=20 DEGREES			RANGE= 20.04 (m)	TIME=1115			
HH		-10.50	-7.60	-6.04	-6.51	-3.93	-0.51
HV	-22.20	-19.70	-14.90	-10.54	-14.05	-10.31	
VV	-11.70	-11.10	-7.10	-2.75	-2.94	-1.61	-0.21
ANGLE=50 DEGREES			RANGE= 29.27 (m)	TIME=1131			
HH	-20.30	-17.90	-15.30	-14.16	-11.71	-6.69	-0.16
HV	-27.50	-24.00	-21.80	-18.14	-18.53	-14.03	
VV	-20.70	-18.50	-16.00	-11.70	-9.88	-6.92	-0.42
ANGLE=70 DEGREES			RANGE= 53.30 (m)	TIME=1143			
HH	-26.00	-26.90	-21.90	-15.74	-14.51	-11.26	-4.01
HV	-37.00	-33.10	-26.90	-21.53	-22.25	-19.12	
VV	-28.30	-25.50		-14.83	-13.29	-10.18	-4.24

DATE: 1/29/80

ANGLE= 0 DEGREES			RANGE= 18.57 (m)	TIME=1200			
HH	10.60	10.00	12.10	12.08	11.35	11.04	2.62
HV				5.90	3.22	4.45	
VV	11.10	10.40	13.00	14.65	13.93	11.64	1.97
ANGLE=20 DEGREES			RANGE= 20.08 (m)	TIME=1220			
HH		-10.20	-7.50	-6.80	-5.76	-3.59	-0.36
HV	-24.50	-21.80	-15.90	-11.42	-13.18	-9.13	
VV	-11.20	-11.30	-8.10		-3.62	-0.77	0.22
ANGLE=50 DEGREES			RANGE= 29.75 (m)	TIME=1238			
HH	-20.30	-18.80	-15.90	-16.53	-10.79	-7.31	-0.49
HV	-31.20	-28.90	-24.80	-19.87	-18.31	-13.17	
VV	-20.40	-18.80	-16.00	-12.13	-9.36	-5.35	0.07
ANGLE=70 DEGREES			RANGE= 54.33 (m)	TIME=1249			
HH	-28.50	-27.40	-22.10	-17.91	-14.09	-10.55	-4.30
HV	-37.50	-34.60	-27.70	-23.52	-22.03	-18.58	
VV	-28.20	-26.10		-15.48	-12.82	-9.78	-4.16

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/29/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.65 (m)			TIME=1302	
HH	10.20	10.10	13.60	10.46	10.70	10.28	2.42
HV		-7.20		3.88	2.50	1.85	
VV	10.40	10.30	14.20	13.59	13.82	11.65	1.09
ANGLE=20 DEGREES			RANGE= 19.96 (m)			TIME=1327	
HH		-10.50	-6.50	-3.94	-5.20	-3.39	0.33
HV	-22.80	-21.40	-15.50	-9.93	-12.52	-9.69	
VV	-9.80	-10.50	-6.10	-1.55	-2.87	-0.37	-1.10
ANGLE=50 DEGREES			RANGE= 29.02 (m)			TIME=1347	
HH		-18.50	-16.00	-13.87	-10.79	-8.42	0.72
HV	-31.80	-28.70	-22.10	-17.56	-18.79	-15.61	
VV	-20.50	-18.60	-16.10	-11.62	-9.34	-6.76	-0.30
ANGLE=70 DEGREES			RANGE= 53.84 (m)			TIME=1358	
HH	-28.10	-26.20	-21.30	-15.72	-14.38	-11.23	-5.08
HV	-38.50	-35.00	-27.80	-21.87	-21.96	-18.90	
VV	-28.00	-25.30		-14.66	-13.40	-9.86	-4.17

DATE: 1/29/80

ANGLE= 0 DEGREES			RANGE= 18.24 (m)			TIME=1412	
HH	12.50	12.10	15.00	11.30	11.10	10.23	3.00
HV				5.92	3.04	3.40	
VV	12.90	12.60	15.40	14.35	13.69	12.65	2.55
ANGLE=20 DEGREES			RANGE= 20.03 (m)			TIME=1438	
HH		-11.00	-7.00	-5.39	-5.87	-3.14	-0.46
HV		-23.10		-11.13	-12.76	-9.53	
VV	-11.90	-11.80	-6.70	-2.62	-3.31	-0.84	-0.06
ANGLE=50 DEGREES			RANGE= 29.51 (m)			TIME=1454	
HH		-18.60	-15.10	-12.41	-10.61	-7.38	-0.26
HV	-31.90	-28.10	-24.20	-16.38	-17.36	-13.75	
VV	-20.40	-18.70	-15.30	-10.63	-9.41	-6.05	0.09
ANGLE=70 DEGREES			RANGE= 54.82 (m)			TIME=1507	
HH	-27.80	-27.00	-20.40	-17.37	-13.83	-9.98	-4.21
HV	-38.40	-35.10	-27.90	-23.19	-21.91	-18.02	
VV	-27.70	-25.10		-15.85	-13.23	-9.38	-3.56

STEAMBOAT SPRINGS, COLORADO 1980
 SCATTERING COEFFICIENT σ^0 (dB)
 TEST SITE # 1, HIBBERT

DATE: 1/29/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 18.74 (m)

TIME=1521

HH 11.40 11.30 13.30 8.93 10.63 10.41 2.17

HV 3.60 3.51 2.09

VV 11.80 11.40 13.80 13.15 14.37 12.34 1.49

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 2, BAR LAZY -L

DATE: 1/30/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 19.11 (m)			TIME= 949	
HH -0.30			4.90	3.20	1.32	4.40	3.29
HV		-14.30		-5.72	-6.59	-5.65	
VV -0.40			4.90	5.66	4.80	7.87	2.70
ANGLE=20 DEGREES			RANGE= 20.82 (m)			TIME=1026	
HH	-14.00		-13.10	-8.14	-8.81	-5.73	0.97
HV -25.00	-25.70		-21.30	-14.59	-14.79	-12.19	
VV	-14.40		-12.40	-5.01	-5.52	-3.17	1.26
ANGLE=50 DEGREES			RANGE= 29.96 (m)			TIME=1046	
HH -23.30	-22.60		-18.70	-16.89	-13.02	-7.37	-0.04
HV	-31.40		-28.40	-22.04	-19.68	-15.49	
VV -23.00	-21.80		-18.30	-13.29	-10.46	-6.19	-0.66
ANGLE=70 DEGREES			RANGE= 56.03 (m)			TIME=1058	
HH -31.20	-28.90		-26.40	-19.15	-14.78	-10.89	-4.99
HV -38.30	-35.40		-32.10	-25.51	-23.79	-19.47	
VV -30.00	-28.30			-17.20	-13.62	-9.31	-3.29

DATE: 1/30/80

ANGLE= 0 DEGREES			RANGE= 19.53 (m)			TIME=1113	
HH -1.30	1.70		5.90	4.09	5.67	6.02	2.05
HV	-16.50			-2.08	-2.89	-1.82	
VV -1.10	1.50		5.60	9.13	9.30	10.46	1.68
ANGLE=20 DEGREES			RANGE= 21.02 (m)			TIME=1137	
HH	-14.50		-12.90	-9.01	-6.81	-2.98	0.80
HV -23.30	-24.20		-20.70	-12.79	-13.34	-9.87	
VV -12.80	-14.80		-11.90	-4.19	-3.70	-1.07	-0.04
ANGLE=50 DEGREES			RANGE= 30.18 (m)			TIME=1153	
HH	-22.30		-18.30	-13.86	-12.08	-7.37	-0.59
HV -31.20	-31.70		-27.30	-19.84	-19.45	-14.10	
VV	-22.70		-18.40	-12.02	-9.74	-6.12	-0.96
ANGLE=70 DEGREES			RANGE= 50.68 (m)			TIME=1203	
HH -30.30	-28.10		-24.50	-18.09	-16.29	-13.04	-7.15
HV -37.80	-34.70		-30.40	-25.33	-24.67	-21.08	
VV -29.60	-28.00			-17.96	-15.01	-12.45	-6.54

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 1/30/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 19.09 (m)		TIME=1216		
HH	0.60	1.50	5.00	3.45	4.27	5.28	2.27
HV		-14.70		-2.74	-3.97	-3.56	
VV	1.20	1.40	4.90	7.41	8.39	8.04	1.49
ANGLE=20 DEGREES			RANGE= 20.51 (m)		TIME=1242		
HH		-14.30	-12.00	-7.27	-9.30	-4.35	-0.60
HV	-23.60	-24.50	-20.30	-12.92	-14.45	-11.28	
VV		-14.80	-11.10	-3.66	-5.75	-3.42	-0.57
ANGLE=50 DEGREES			RANGE= 29.52 (m)		TIME=1300		
HH	-21.90	-21.10	-17.30	-14.55	-12.66	-7.43	-0.69
HV		-31.30	-26.60	-19.65	-19.88	-15.61	
VV	-21.30	-21.20	-17.30	-13.41	-10.55	-7.19	-1.40
ANGLE=70 DEGREES			RANGE= 55.79 (m)		TIME=1310		
HH	-30.70	-28.50	-24.80	-17.92	-14.73	-10.40	-5.66
HV	-37.20	-34.20	-30.20	-25.09	-23.95	-19.78	
VV	-29.50	-28.10		-17.43	-13.54	-11.49	-5.05

DATE: 1/30/80

ANGLE= 0 DEGREES			RANGE= 20.03 (m)		TIME=1450		
HH	1.90	4.50	8.60	7.06	7.33	4.77	3.43
HV	-11.60	-10.50		2.26	-1.27	-3.35	
VV	1.50	4.20	8.80	9.92	10.22	7.68	2.27
ANGLE=20 DEGREES			RANGE= 21.01 (m)		TIME=1510		
HH		-10.80	-7.70	-6.17	-6.10	-2.53	0.98
HV	-22.90	-21.50	-16.20	-11.40	-12.08	-8.64	
VV	-12.20	-11.10	-7.20	-3.56	-3.36	-0.52	-0.30
ANGLE=50 DEGREES			RANGE= 30.13 (m)		TIME=1534		
HH	-29.90	-19.40	-15.20	-13.67	-10.52	-7.10	0.28
HV	-31.20	-27.70	-23.50	-18.55	-18.24	-15.33	
VV	-21.60	-20.20	-15.50	-11.01	-9.08	-6.41	-0.17
ANGLE=70 DEGREES			RANGE= 57.33 (m)		TIME=1548		
HH	-28.40	-27.70	-22.40	-16.56	-13.25	-9.97	-5.01
HV	-37.10	-33.80	-27.10	-22.58	-21.83	-17.81	
VV	-28.60	-25.70		-15.01	-12.85	-9.84	-4.28

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBEFT

DATE: 1/31/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.85 (m)			TIME=1620	
HH	6.30	3.60	6.80	10.08	8.65	5.34	1.73
HV				4.78	0.41	-1.38	
VV	7.30	4.60	6.40	11.77	10.72	7.31	1.63
ANGLE=20 DEGREES			RANGE= 20.38 (m)			TIME=1640	
HH		-14.60	-9.20	-5.68	-5.53	-3.92	1.03
HV		-26.50		-9.42	-12.75	-9.90	
VV	-11.00	-14.00	-7.60	-3.18	-3.43	-1.63	1.18
ANGLE=50 DEGREES			RANGE= 30.13 (m)			TIME=1553	
HH		-19.60	-14.90	-12.40	-10.34	-7.42	0.80
HV		-30.70		-17.74	-18.72	-14.72	
VV	-20.20	-18.70	-16.00	-11.50	-9.09	-6.13	0.61
ANGLE=70 DEGREES			RANGE= 57.66 (m)			TIME=1704	
HH	-29.00	-28.20	-24.90	-14.90	-12.94	-9.61	-4.35
HV		-37.20	-32.60	-20.63	-22.39	-18.06	
VV	-27.90	-26.40		-15.04	-13.05	-9.58	-4.02

DATE: 2/ 1/80

ANGLE= 0 DEGREES			RANGE= 18.60 (m)			TIME=1040	
HH	7.80	7.50	8.80	5.88	4.98	2.74	2.79
HV		-8.60		-2.60	-4.12	-6.96	
VV	8.20	7.80	8.50	9.46	8.29	4.92	1.70
ANGLE=20 DEGREES			RANGE= 20.09 (m)			TIME=1111	
HH		-9.70	-7.90	-4.73	-5.29	-2.86	-0.35
HV	-21.80	-22.00	-16.50	-10.92	-12.63	-10.60	
VV	-7.90	-8.80	-8.60	-1.26	-2.11	-1.62	-0.35
ANGLE=50 DEGREES			RANGE= 28.67 (m)			TIME=1128	
HH	-20.10	-18.60	-16.10	-13.76	-10.65	-6.03	-0.23
HV	-31.50	-27.90	-24.30	-18.39	-18.31	-14.70	
VV	-18.90	-17.20	-16.30	-11.22	-9.59	-5.92	-1.20
ANGLE=70 DEGREES			RANGE= 51.11 (m)			TIME=1141	
HH	-28.70	-28.40	-23.80	-16.34	-13.94	-9.62	-4.21
HV	-38.10	-35.00	-30.20	-21.29	-22.24	-17.92	
VV	-27.10	-26.40		-15.15	-13.51	-9.64	-4.06

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 2/ 1/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE=	18.57 (m)	TIME=1155		
HH	4.50	3.20	9.70	8.26	9.12	8.06	1.03
HV		-14.00		2.81	-0.46	-0.89	
VV	5.30	4.40	9.40	12.04	11.92	10.12	0.38
ANGLE=20 DEGREES			RANGE=	20.28 (m)	TIME=1220		
HH		-11.90	-7.90	-6.71	-6.83	-2.46	-1.86
HV	-25.00	-24.20		-9.82	-11.72	-10.63	
VV	-10.00	-11.90	-6.50	-2.87	-4.58	-1.57	-1.61
ANGLE=50 DEGREES			RANGE=	29.92 (m)	TIME=1236		
HH		-21.60	-17.50	-13.71	-10.58	-6.50	-1.46
HV	-34.40	-30.90	-25.90	-18.27	-18.35	-14.91	
VV		-19.90	-16.00	-11.11	-9.38	-5.72	-1.55
ANGLE=70 DEGREES			RANGE=	57.37 (m)	TIME=1247		
HH	-29.20	-26.50	-22.80	-16.07	-13.99	-9.98	-5.75
HV	-36.70	-34.30	-28.80	-22.89	-22.99	-19.09	
VV	-27.70	-25.20		-15.30	-13.73	-11.18	-6.01

DATE: 2/ 1/80

ANGLE= 0 DEGREES			RANGE=	18.21 (m)	TIME=1314		
HH	6.30	5.70	10.00	8.08	8.06	6.95	1.63
HV				2.16	-0.75	-0.72	
VV	6.80	7.10	10.40	10.82	10.31	7.76	0.88
ANGLE=20 DEGREES			RANGE=	20.49 (m)	TIME=1332		
HH		-13.40	-6.10	-7.07	-4.67	-2.90	-0.99
HV		-24.20	-16.90	-11.50	-13.31	-10.25	
VV	-10.70	-12.60	-5.80	-4.05	-1.86	-1.47	-1.33
ANGLE=50 DEGREES			RANGE=	28.29 (m)	TIME=1352		
HH		-19.60	-17.70	-15.05	-12.64	-9.46	-2.33
HV	-34.20	-29.30	-26.20	-19.17	-20.05	-17.65	
VV	-21.20	-18.90	-15.50	-12.91	-12.69	-10.48	-3.80
ANGLE=70 DEGREES			RANGE=	58.95 (m)	TIME=1403		
HH	-28.40	-26.10	-21.10	-16.28	-15.21	-9.43	-5.67
HV	-36.60	-34.00	-27.80	-22.28	-23.32	-19.24	
VV	-27.50	-25.30		-15.16	-13.92	-11.55	-5.53

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 2/ 1/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE=	18.67 (m)	TIME=1429		
HH	6.40	3.50	10.50	6.13	7.30	6.59	0.99
HV		-11.60		0.55	-1.59	-3.01	
VV	7.20	4.30	11.00	9.82	10.44	7.83	-0.15
ANGLE=20 DEGREES			RANGE=	20.22 (m)	TIME=1453		
HH		-11.80	-5.40	-6.65	-6.32	-2.52	-0.41
HV	-23.90	-23.00		-11.17	-12.49	-10.15	
VV	-11.10	-11.80	-5.90	-2.16	-4.43	-1.24	-0.04
ANGLE=50 DEGREES			RANGE=	30.44 (m)	TIME=1510		
HH	-19.80	-16.10	-13.10	-13.87	-10.08	-6.62	-0.79
HV	-30.60	-26.20	-22.60	-17.79	-17.74	-14.95	
VV	-19.40	-15.40	-12.90	-10.90	-9.09	-6.67	-0.69
ANGLE=70 DEGREES			RANGE=	59.98 (m)	TIME=1522		
HH	-28.60	-26.40	-20.90	-16.02	-14.06	-9.98	-5.09
HV	-37.40	-34.50	-27.90	-22.70	-22.28	-18.61	
VV	-27.30	-25.60		-15.35	-13.71	-10.77	-5.30

DATE: 2/ 4/80

ANGLE= 0 DEGREES			RANGE=	19.04 (m)	TIME=1208		
HH				4.52	4.68	5.17	1.85
HV				0.40	-2.23	-2.54	
VV				8.11	7.62	5.23	1.27
ANGLE=20 DEGREES			RANGE=	21.13 (m)	TIME=1230		
HH				-7.21	-5.05	-3.26	0.24
HV				-10.99	-13.46	-9.32	
VV				-2.89	-1.56	-1.41	-0.56
ANGLE=50 DEGREES			RANGE=	31.30 (m)	TIME=1246		
HH				-13.24	-11.21	-6.65	-0.33
HV				-17.80	-18.63	-14.40	
VV				-10.67	-9.50	-6.73	-1.07
ANGLE=70 DEGREES			RANGE=	62.97 (m)	TIME=1255		
HH				-16.79	-14.43	-10.48	-5.00
HV				-21.98	-22.69	-19.53	
VV				-14.18	-13.53	-10.42	-5.23

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 2/ 4/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES	RANGE= 19.14 (m)			TIME=1309			
HH			7.64	8.13	7.20		2.51
HV			1.39	0.60	-1.56		
VV			10.49	11.40	9.11		1.81
ANGLE=20 DEGREES	RANGE= 21.05 (m)			TIME=1329			
HH			-5.03	-5.06	-2.74		0.76
HV			-10.48	-11.46	-9.34		
VV			-1.21	-2.73	-0.83		-0.10
ANGLE=50 DEGREES	RANGE= 30.04 (m)			TIME=1344			
HH			-13.17	-11.13	-7.50		0.13
HV			-17.72	-18.69	-15.21		
VV			-11.24	-9.10	-5.91		-0.67
ANGLE=70 DEGREES	RANGE= 58.56 (m)			TIME=1352			
HH			-15.71	-13.89	-9.74		-4.51
HV			-22.07	-22.30	-18.55		
VV			-14.69	-13.41	-9.86		-4.52

DATE: 2/ 4/80

ANGLE= 0 DEGREES	RANGE= 19.63 (m)			TIME=1407			
HH			6.17	6.35	5.71		0.62
HV			0.04	-1.94	-4.57		
VV			8.27	10.06	8.52		0.24
ANGLE=20 DEGREES	RANGE= 21.71 (m)			TIME=1425			
HH			-5.22	-5.05	-3.61		-0.29
HV			-11.60	-11.25	-10.47		
VV			-4.26	-2.12	-2.28		-0.95
ANGLE=50 DEGREES	RANGE= 30.63 (m)			TIME=1436			
HH			-12.56	-10.69	-6.44		-0.25
HV			-17.58	-18.39	-14.46		
VV			-10.36	-9.25	-5.43		0.24
ANGLE=70 DEGREES	RANGE= 58.82 (m)			TIME=1444			
HH			-15.65	-13.70	-10.33		-5.04
HV			-22.44	-23.30	-18.41		
VV			-15.80	-13.47	-10.64		-4.34

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 2/ 4/80

FREQUENCY (GHZ)		1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0	DEGREES	RANGE= 19.35 (m)		TIME=1456				
HH				7.77	8.53	6.86	1.99	
HV				2.00	-0.77	-2.11		
VV				10.88	11.29	8.95	1.34	
ANGLE=20	DEGREES	RANGE= 21.00 (m)		TIME=1515				
HH				-4.30	-4.45	-1.51	1.41	
HV				-9.68	-11.11	-9.78		
VV				-2.38	-2.19	-0.31	1.01	
ANGLE=50	DEGREES	RANGE= 30.94 (m)		TIME=1528				
HH				-13.84	-10.74	-6.77	0.05	
HV				-18.51	-19.21	-14.81		
VV				-10.29	-9.37	-5.77	-0.11	
ANGLE=70	DEGREES	RANGE= 59.04 (m)		TIME=1536				
HH				-15.95	-13.82	-10.53	-4.50	
HV				-22.16	-22.41	-19.07		
VV				-15.22	-12.98	-10.36	-4.44	

DATE: 2/ 4/80

ANGLE= 0	DEGREES	RANGE= 19.39 (m)		TIME=1549				
HH				8.04	9.82	7.34	1.64	
HV				1.89	0.10	-1.23		
VV				10.25	12.50	8.64	1.27	
ANGLE=20	DEGREES	RANGE= 20.97 (m)		TIME=1605				
HH				-4.87	-5.06	-2.56	0.74	
HV				-9.82	-11.75	-9.64		
VV				-1.71	-2.78	-1.50	-0.29	
ANGLE=50	DEGREES	RANGE= 30.98 (m)		TIME=1618				
HH				-11.46	-9.23	-6.30	0.01	
HV				-15.69	-17.24	-13.05		
VV				-8.79	-7.55	-4.75	-0.38	
ANGLE=70	DEGREES	RANGE= 59.84 (m)		TIME=1625				
HH				-15.68	-13.74	-9.67	-5.45	
HV				-21.28	-22.52	-18.75		
VV				-14.49	-13.34	-9.88	-4.13	

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 2, BAR LAZY -L

DATE: 2/ 7/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 20.04 (m)		TIME=1210		
HH			5.25		7.50	7.52	4.86
HV			-0.32		-1.12	-0.68	
VV			9.44		10.75	8.68	3.98
ANGLE=20 DEGREES			RANGE= 22.75 (m)		TIME=1242		
HH			-8.42		-4.90	-2.53	0.68
HV			-12.80		-12.80	-11.30	
VV			-3.93		-1.97	-1.62	0.92
ANGLE=50 DEGREES			RANGE= 30.36 (m)		TIME=1304		
HH			-16.07		-12.88	-9.65	-1.88
HV			-19.20		-21.37	-17.80	
VV			-12.84		-12.47	-9.48	-2.46
ANGLE=70 DEGREES			RANGE= 60.85 (m)		TIME=1316		
HH			-17.33		-13.43	-10.69	-5.51
HV			-23.59		-23.63	-19.68	
VV			-15.53		-13.19	-11.90	-4.68

DATE: 2/ 7/80

ANGLE= 0 DEGREES			RANGE= 19.55 (m)		TIME=1331		
HH			4.79		3.53	2.55	3.67
HV			-1.38		-4.91	-4.34	
VV			7.14		5.02	3.27	2.89
ANGLE=20 DEGREES			RANGE= 22.18 (m)		TIME=1402		
HH			-7.57		-5.28	-2.93	0.54
HV			-12.50		-12.89	-10.44	
VV			-3.70		-3.73	-2.09	1.49
ANGLE=50 DEGREES			RANGE= 31.88 (m)		TIME=1423		
HH			-14.96		-11.38	-6.59	-0.40
HV			-18.17		-18.43	-14.40	
VV			-11.98		-10.58	-6.63	-0.71
ANGLE=70 DEGREES			RANGE= 61.61 (m)		TIME=1434		
HH			-18.36		-13.38	-10.70	-5.47
HV			-23.90		-22.87	-19.27	
VV			-15.80		-13.21	-10.33	-4.78

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 2, BAR LAZY -L

DATE: 2/ 7/80

FREQUENCY (GHZ)		1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0	DEGREES	RANGE= 20.21 (m)		TIME=1450				
HH					6.89	6.63	8.78	4.43
HV					0.88	-1.53	-0.70	
VV					9.85	9.96	9.59	4.22
ANGLE=20	DEGREES	RANGE= 22.27 (m)		TIME=1505				
HH					-4.11	-5.22	-2.14	1.21
HV					-11.90	-12.38	-9.71	
VV					-1.41	-3.41	-1.13	1.34
ANGLE=50	DEGREES	RANGE= 32.03 (m)		TIME=1522				
HH					-12.05	-10.48	-7.62	0.31
HV					-17.32	-18.72	-14.62	
VV					-10.97	-9.36	-6.81	-0.14
ANGLE=70	DEGREES	RANGE= 60.30 (m)		TIME=1531				
HH					-15.28	-13.86	-9.35	-5.22
HV					-21.67	-22.01	-18.38	
VV					-16.34	-12.55	-9.48	-3.18

DATE: 2/ 7/80

ANGLE= 0	DEGREES	RANGE= 20.25 (m)		TIME=1546				
HH					6.60	5.68	5.22	3.73
HV					0.88	-3.69	-3.45	
VV					8.97	7.26	7.17	3.76
ANGLE=20	DEGREES	RANGE= 22.15 (m)		TIME=1603				
HH					-6.41	-4.20	-0.83	1.16
HV					-10.60	-12.57	-8.47	
VV					-3.67	-3.09	-1.33	0.97
ANGLE=50	DEGREES	RANGE= 31.75 (m)		TIME=1617				
HH					-11.88	-10.52	-8.08	0.09
HV					-17.52	-19.09	-14.74	
VV					-11.89	-10.66	-7.61	-0.37
ANGLE=70	DEGREES	RANGE= 60.53 (m)		TIME=1628				
HH					-15.76	-14.21	-10.83	-4.12
HV					-22.67	-22.55	-20.00	
VV					-15.96	-11.83	-9.76	-2.82

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 2, BAR LAZY -L

DATE: 2/ 9/80

FREQUENCY (GHZ)		1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0	DEGREES	RANGE= 19.30 (m)		TIME=1510				
HH	4.90	1.80	6.70	2.84	2.91	4.52	2.10	
HV		-16.00		-3.76	-4.23	-3.77		
VV	5.30	2.60	5.50	7.10	5.54	5.88	1.11	
ANGLE=20	DEGREES	RANGE= 20.45 (m)		TIME=1533				
HH		-12.00	-8.80	-8.32	-7.94	-4.04	-0.16	
HV		-25.60		-12.13	-12.28	-10.09		
VV	-10.00	-11.80	-8.90	-3.83	-5.58	-2.60		
ANGLE=50	DEGREES	RANGE= 29.51 (m)		TIME=1548				
HH	-22.30	-21.10	-16.80	-13.59	-11.60	-7.28	-0.72	
HV		-32.90		-19.04	-20.42	-15.46		
VV	-20.40	-20.70	-17.20	-11.98	-11.27	-7.73	-1.19	
ANGLE=70	DEGREES	RANGE= 54.93 (m)		TIME=1602				
HH	-30.40	-28.80	-23.00	-16.76	-14.81	-10.56	-5.58	
HV		-38.50	-32.20	-22.74	-22.92	-19.48		
VV	-26.50	-25.60		-15.99	-13.62	-10.80	-4.87	

DATE: 2/ 9/80

ANGLE=50	DEGREES	RANGE= 29.56 (m)		TIME=1618				
HH	-21.10	-20.30	-16.60	-12.66	-11.21	-6.88	-0.61	
HV		-32.90		-19.47	-20.12	-14.86		
VV	-19.70	-19.20	-17.70	-10.94	-10.95	-6.99	-1.30	
ANGLE=70	DEGREES	RANGE= 53.84 (m)		TIME=1630				
HH	-29.50	-28.40	-23.00	-16.09	-14.67	-10.59	-4.69	
HV		-36.80	-31.10	-22.24	-22.56	-18.52		
VV	-26.90	-26.50		-16.47	-13.21	-10.31	-3.97	

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 2/10/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.18 (m)	TIME=1245			
HH	11.10	7.40	8.70	7.92	9.74	8.93	2.94
HV				1.96	0.15	-0.57	
VV	11.90	9.00	8.30	11.80	12.77	11.43	2.35
ANGLE=20 DEGREES			RANGE= 20.26 (m)	TIME=1300			
HH		-9.00	-7.90	-5.37	-4.51	-3.53	-0.11
HV		-24.00		-11.11	-11.67	-9.25	
VV	-9.40	-7.80	-8.60	-0.80	-1.80	-1.34	-0.51
ANGLE=50 DEGREES			RANGE= 28.95 (m)	TIME=1330			
HH		-20.30	-16.20	-14.79	-10.71	-7.69	-1.66
HV		-32.10		-18.23	-17.89	-13.55	
VV	-19.50	-18.70	-15.60	-11.55	-9.01	-6.26	-1.01
ANGLE=70 DEGREES			RANGE= 52.48 (m)	TIME=1345			
HH	-28.20	-28.40	-23.80	-16.42	-14.31	-9.29	-4.84
HV		-38.60		-22.77	-21.84	-16.87	
VV	-25.90	-26.60		-15.34	-12.64	-8.95	-4.64

DATE: 2/10/80

ANGLE= 0 DEGREES			RANGE= 18.40 (m)	TIME=1410			
HH	9.10	5.20	8.40	9.45	10.62	10.78	1.52
HV				3.08	1.97	1.14	
VV	9.90	6.10	8.50	13.84	14.82	13.05	0.17
ANGLE=20 DEGREES			RANGE= 19.64 (m)	TIME=1430			
HH		-6.90	-7.80	-5.71	-5.79	-2.08	-1.16
HV		-23.50	-18.70	-10.45	-11.70	-9.51	
VV	-8.00	-6.40	-8.10	-1.38	-3.31	0.35	-1.67
ANGLE=50 DEGREES			RANGE= 27.26 (m)	TIME=1500			
HH	-20.50	-19.20	-16.10	-15.23	-12.42	-7.30	-2.54
HV		-30.30	-26.20	-18.92	-19.90	-15.51	
VV	-18.90	-17.60	-16.30	-10.75	-10.17	-7.03	-3.15
ANGLE=70 DEGREES			RANGE= 52.03 (m)	TIME=1511			
HH	-27.10	-26.30	-22.30	-16.43	-14.49	-10.21	-6.21
HV		-37.80	-32.90	-22.41	-21.65	-17.30	
VV	-26.20	-24.90		-15.04	-12.92	-9.99	-5.10

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIRBERT

DATE: 2/10/80

FREQUENCY (GHZ)	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES			RANGE= 18.41 (m)	TIME=1536			
HH	11.60	8.70	11.20	9.36	10.29	11.25	1.15
HV				3.41	3.16	2.55	
VV	12.80	10.10	11.60	13.93	14.04	12.83	0.26
ANGLE=20 DEGREES			RANGE= 19.81 (m)	TIME=1558			
HH	-7.30	-5.70	-7.10	-5.29	-4.91	-3.01	-0.68
HV		-22.40		-9.55	-10.52	-7.11	
VV	-6.60	-5.70	-7.50	-1.23	-1.75	-0.56	-1.04
ANGLE=50 DEGREES			RANGE= 28.34 (m)	TIME=1615			
HH	-21.10	-19.40	-15.10	-14.58	-10.92	-7.42	-0.33
HV		-31.80		-18.90	-17.87	-13.79	
VV	-18.40	-17.80	-15.10	-11.34	-9.39	-7.26	-0.62
ANGLE=70 DEGREES			RANGE= 53.19 (m)	TIME=1620			
HH	-27.40	-26.10	-21.80	-17.06	-14.27	-10.10	-4.41
HV		-37.60	-32.60	-21.93	-21.44	-17.65	
VV	-26.20	-24.80		-14.57	-12.26	-9.82	-3.87

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 3, RABBIT EAR'S PASS

DATE: 2/11/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES	RANGE= 18.32 (m)			TIME=1325			
HH	6.50	3.80	6.10	5.04	1.05	3.05	3.39
HV				-2.66	-6.14	-5.02	
VV	6.30	4.60	5.00	7.22	4.18	5.05	3.27
ANGLE=20 DEGREES	RANGE= 20.17 (m)			TIME=1400			
HH		-16.40	-11.50	-10.40	-11.66	-8.31	-1.47
HV				-14.93	-16.40	-14.43	
VV		-15.90		-6.72	-9.20	-6.64	-0.65
ANGLE=50 DEGREES	RANGE= 29.86 (m)			TIME=1420			
HH	-21.40	-20.80	-19.50	-17.38	-14.33	-9.18	-2.07
HV		-36.60		-21.25	-20.04	-15.65	
VV	-20.70	-19.80	-19.60	-15.01	-11.45	-8.56	-2.02
ANGLE=70 DEGREES	RANGE= 55.20 (m)			TIME=1430			
HH	-24.20	-24.90	-22.80	-18.60	-17.47	-13.67	-6.32
HV		-38.50		-25.36	-25.17	-20.68	
VV	-22.80	-23.40		-17.23	-14.99	-11.40	-5.05

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 3, RABBIT EAR'S PASS

DATE: 2/11/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE=10 DEGREES							
RANGE=			19.74 (m)		TIME=1504		
HH	2.40	-1.70	1.70	0.97	-0.90	-0.23	0.50
HV				-6.94	-10.38	-7.83	
VV	2.30	-1.60	1.20	4.03	1.24	1.43	-0.21
ANGLE=20 DEGREES							
RANGE=			20.81 (m)		TIME=1526		
HH		-15.80	-11.20	-7.18	-9.03	-5.91	-1.55
HV				-12.94	-15.14	-11.69	
VV		-15.00	-11.90	-5.03	-6.61	-3.37	-0.42
ANGLE=30 DEGREES							
RANGE=			22.24 (m)		TIME=1546		
HH		-16.80	-14.10	-10.43	-11.56	-7.00	0.12
HV				-16.12	-17.68	-13.94	
VV -15.30	-15.90	-13.70	-8.73	-9.35	-5.89		
ANGLE=40 DEGREES							
RANGE=			25.22 (m)		TIME=1600		
HH		-16.50	-15.00	-12.51	-11.97	-7.26	-1.58
HV				-17.15	-19.27	-15.76	
VV		-16.30	-16.10	-9.96	-9.70	-5.92	-0.92
ANGLE=50 DEGREES							
RANGE=			29.97 (m)		TIME=1610		
HH	-21.40	-20.80	-16.50	-16.44	-13.74	-8.49	-1.58
HV		-35.60		-21.48	-20.86	-15.57	
VV -19.90	-19.50	-17.10	-13.88	-10.34	-6.86		-1.25
ANGLE=60 DEGREES							
RANGE=			37.92 (m)		TIME=1622		
HH	-25.20	-25.20	-20.90	-15.68	-14.63	-8.93	-4.00
HV		-37.40		-21.08	-21.68	-16.16	
VV -22.40	-22.00	-20.10	-12.48	-11.29	-8.10		-2.65
ANGLE=70 DEGREES							
RANGE=			55.88 (m)		TIME=1631		
HH	-29.70	-28.80	-23.60	-19.24	-16.97	-12.78	-5.60
HV		-42.40		-25.72	-24.40	-19.18	
VV -26.20	-27.00		-17.76	-14.52	-10.66		-3.94
ANGLE=80 DEGREES							
RANGE=			85.74 (m)		TIME=1645		
HH				-22.48	-22.16	-18.42	-11.24
HV				-28.92	-28.75	-26.36	
VV				-22.20	-20.30	-18.11	-9.10

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 2/14/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 18.30 (m) TIME=1240

HH 8.40 8.60 7.20

HV -9.70

VV 9.10 9.70 7.70

ANGLE=10 DEGREES RANGE= 18.70 (m)

HH 3.30 0.50 2.30

HV -16.20

VV 4.60 1.30 2.00

ANGLE=20 DEGREES RANGE= 19.50 (m)

HH -7.70 -9.40 -6.60

HV -18.50 -21.80 -15.50

VV -6.70 -8.50 -5.80

ANGLE=30 DEGREES RANGE= 21.10 (m)

HH -11.40 -14.30 -8.40

HV -23.60 -24.10

VV -10.60 -13.80 -8.60

ANGLE=40 DEGREES RANGE= 23.80 (m)

HH -15.30 -13.90 -10.50

HV -28.70 -26.30 -20.60

VV -14.70 -14.80 -9.60

ANGLE=50 DEGREES RANGE= 28.20 (m)

HH -16.90 -15.40 -11.10

HV -30.70 -26.60

VV -16.90 -14.20 -12.20

ANGLE=60 DEGREES RANGE= 34.70 (m)

HH -25.40 -23.00 -19.10

HV -35.80 -32.90 -27.20

VV -23.10 -20.10 -17.70

ANGLE=70 DEGREES RANGE= 46.20 (m)

HH -27.50 -26.30 -22.80

HV -37.80 -34.80 -28.70

VV -25.40 -24.60 -21.40

ANGLE=80 DEGREES RANGE= 79.40 (m)

HH -31.70 -28.80 -27.20

HV -41.20 -38.10

VV -31.30 -28.50 -25.90

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 2/16/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 18.30 (m) TIME=1400

HH 8.70 8.40 10.30

HV

VV 9.60 9.00 10.10

ANGLE=10 DEGREES RANGE= 18.80 (m)

HH 2.60 -1.20 -0.40

HV -17.40

VV 3.30 -0.70 -0.10

ANGLE=30 DEGREES RANGE= 20.70 (m)

HH -7.20 -12.30 -12.40

HV -23.50

VV -6.80 -11.80 -11.90

ANGLE=50 DEGREES RANGE= 27.90 (m)

HH -14.10 -16.10 -19.50

HV -27.00

VV -14.40 -16.20 -18.00

ANGLE=70 DEGREES RANGE= 45.50 (m)

HH -20.20 -23.30 -24.20

HV -28.60 -31.50 -32.80

VV -20.50 -21.20 -24.30

ANGLE=80 DEGREES RANGE= 69.70 (m)

HH -26.40 -28.60 -27.10

HV -34.20 -35.90 -35.90

VV -25.10 -27.00

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 2/17/80

FREQUENCY (GHZ)
1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 18.10 (m) TIME=1010

HH 15.50 18.70 26.50

HV

VV 14.80 19.20 26.90

ANGLE=10 DEGREES RANGE= 18.30 (m)

HH -10.60 -12.40

HV -22.40 -27.30

VV -3.90 -11.60

ANGLE=20 DEGREES RANGE= 19.10 (m)

HH -20.60

HV

VV

ANGLE=30 DEGREES RANGE= 20.80 (m)

HH -22.50

HV

VV

ANGLE=40 DEGREES RANGE= 22.70 (m)

HH

HV

VV -20.10

ANGLE=50 DEGREES RANGE= 26.80 (m)

HH -22.70 -20.80

HV

VV -19.50 -18.10

ANGLE=60 DEGREES RANGE= 33.60 (m)

HH -30.60

HV -40.20

VV -28.20 -24.90 -21.40

ANGLE=70 DEGREES RANGE= 30.80 (m)

HH

HV

VV -27.10 -25.60

ANGLE=80 DEGREES RANGE= 30.10 (m)

HH

HV -41.10

VV -32.00 -25.20

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 2/23/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES							
HH -4.50			RANGE= 18.49 (m)	TIME=1007			
HV			3.05	3.72	6.39	1.12	
VV			-3.07	-4.86	-2.06		
			5.56	6.47	9.52	0.61	
ANGLE=20 DEGREES							
HH -14.00			RANGE= 19.38 (m)	TIME=1032			
HV			-10.14	-8.95	-6.14	-1.79	
VV			-16.00	-17.15	-12.95		
			-6.96	-6.48	-4.41	-1.95	
ANGLE=50 DEGREES							
HH -18.60			RANGE= 26.32 (m)	TIME=1048			
HV			-16.42	-13.47	-9.07	-2.48	
VV			-23.39	-21.96	-16.84		
			-15.76	-12.56	-8.56	-2.78	
ANGLE=70 DEGREES							
HH -23.60			RANGE= 43.65 (m)	TIME=1100			
HV			-20.53	-17.18	-12.21	-7.15	
VV			-28.28	-25.92	-21.02		
			-21.12	-17.22	-14.55	-6.03	

DATE: 2/23/80

ANGLE= 0 DEGREES							
HH -4.80			RANGE= 18.27 (m)	TIME=1115			
HV			6.61	6.43	9.26	-0.46	
VV			-1.43	-2.24	-1.38		
			8.97	7.68	10.07	-1.36	
ANGLE=20 DEGREES							
HH -15.70			RANGE= 18.92 (m)	TIME=1136			
HV			-10.77	-9.68	-6.89	-3.93	
VV			-16.15	-17.55	-14.17		
			-7.71	-7.97	-5.92	-4.01	
ANGLE=50 DEGREES							
HH -20.50			RANGE= 25.85 (m)	TIME=1150			
HV			-18.41	-15.91	-11.86	-6.90	
VV			-23.95	-23.41	-19.68		
			-16.57	-15.24	-11.96	-6.04	
ANGLE=70 DEGREES							
HH -30.01			RANGE= 43.82 (m)	TIME=1203			
HV			-21.35	-18.27	-15.04	-10.65	
VV			-29.38	-27.13	-23.59		
			-21.20	-18.36	-15.53	-10.45	

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 2/23/80

FREQUENCY (GHZ)

1.6 2.5 4.4 8.6 13.0 17.0 35.6

ANGLE= 0 DEGREES RANGE= 19.50 (m) TIME=1222

HH -6.70

HV

VV

ANGLE=20 DEGREES RANGE= 19.22 (m) TIME=1300

HH -15.10 -8.60 -9.90 -6.97 -2.89

HV -15.57 -17.02 -15.08

VV -6.76 -7.42 -4.97 -3.94

ANGLE=50 DEGREES RANGE= 26.05 (m) TIME=1313

HH -20.20 -21.26 -15.60 -11.04 -6.76

HV -25.20 -23.43 -18.76

VV -15.91 -15.30 -11.09 -6.85

ANGLE=70 DEGREES RANGE= 43.65 (m) TIME=1324

HH -29.60 -20.06 -18.76 -14.19 -10.70

HV -29.37 -27.82 -22.49

VV -21.44 -18.11 -14.79 -10.25

DATE: 2/23/80

ANGLE= 0 DEGREES RANGE= 17.88 (m) TIME=1341

HH -6.00 4.97 5.37 5.68 -0.51

HV -2.06 -2.10 -3.94

VV 6.65 7.71 8.30 -0.38

ANGLE=20 DEGREES RANGE= 19.06 (m) TIME=1405

HH -14.70 -9.03 -9.05 -7.85 -3.96

HV -16.10 -17.71 -14.80

VV -7.29 -7.11 -5.26 -3.67

ANGLE=50 DEGREES RANGE= 25.77 (m) TIME=1425

HH -25.00 -19.20 -15.85 -11.69 -5.86

HV -26.63 -23.36 -19.57

VV -17.22 -15.66 -10.33 -5.97

ANGLE=70 DEGREES RANGE= 42.71 (m) TIME=1440

HH -30.00 -19.25 -19.82 -14.46 -8.99

HV -27.77 -28.03 -23.23

VV -20.28 -19.61 -15.38 -8.52

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 2/23/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES							
RANGE=			17.76 (m)		TIME=1500		
HH -5.70			5.53	6.32	9.07		-0.19
HV			-1.08	-0.46	0.34		
VV			6.80	7.12	11.79		-0.63
ANGLE=20 DEGREES							
RANGE=			18.68 (m)		TIME=1523		
HH -15.40			-10.49	-10.16	-8.10		-4.20
HV			-16.40	-17.24	-15.02		
VV			-7.97	-7.78	-5.60		-4.00
ANGLE=50 DEGREES							
RANGE=			26.52 (m)		TIME=1545		
HH -25.20			-16.91	-14.94	-9.32		-5.06
HV			-23.38	-23.19	-19.93		
VV			-15.67	-14.03	-9.66		-5.53
ANGLE=70 DEGREES							
RANGE=			41.27 (m)		TIME=1600		
HH -29.70			-21.25	-19.22	-14.90		-9.13
HV			-29.39	-28.07	-23.38		
VV			-21.97	-18.91	-15.11		-8.97

DATE: 2/23/80

ANGLE=50 DEGREES							
RANGE=			26.32 (m)		TIME=1624		
HH -21.00			-17.58	-14.39	-9.56		-5.49
HV			-24.88	-23.20	-18.17		
VV			-17.09	-13.69	-9.43		-5.48

STEAMBOAT SPRINGS, COLORADO 1980
SCATTERING COEFFICIENT σ^0 (dB)
TEST SITE # 1, HIBBERT

DATE: 2/25/80

FREQUENCY (GHZ)

	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE= 0 DEGREES	RANGE= 18.38 (m)			TIME=1220			
HH				7.87	7.10	10.07	1.88
HV				0.59	-1.50	0.76	
VV				9.72	8.22	11.23	0.83
ANGLE=20 DEGREES	RANGE= 19.37 (m)			TIME=1245			
HH				0.11	-4.52	-2.14	-0.39
HV				-5.90		-13.14	
VV				3.48	-3.19	-2.74	-1.47
ANGLE=50 DEGREES	RANGE= 26.93 (m)			TIME=1257			
HH				-9.14	-11.46	-6.28	-1.44
HV				-14.40		-19.80	
VV				-8.05	-11.28	-5.54	-2.21
ANGLE=70 DEGREES	RANGE= 43.16 (m)			TIME=1308			
HH				-16.02	-13.66	-9.37	-4.53
HV				-23.27	-22.56	-17.58	
VV				-16.38	-13.81	-10.00	-4.71

DATE: 2/25/80

ANGLE= 0 DEGREES	RANGE= 18.12 (m)			TIME=1522			
HH				5.69	2.65	2.07	-2.16
HV				-3.96	-1.84	-3.38	
VV				6.61	1.36	2.99	-3.86
ANGLE=20 DEGREES	RANGE= 19.50 (m)			TIME=1527			
HH				-2.71	-5.06	-4.18	-6.38
HV				-8.24	-11.38	-8.73	
VV				-0.44	-3.07	-2.28	-7.24
ANGLE=50 DEGREES	RANGE= 27.22 (m)			TIME=1540			
HH				-11.44	-10.80	-8.40	-7.93
HV				-14.04	-15.51	-14.69	
VV				-7.61	-8.45	-6.81	-8.97
ANGLE=70 DEGREES	RANGE= 30.20 (m)			TIME=1555			
HH				-15.11	-13.20	-12.31	-10.88
HV				-18.20	-21.30	-18.55	
VV				-14.29	-13.38	-12.35	-11.69

STEAMBOAT SPRINGS, COLORADO 1980
 SCATTERING COEFFICIENT σ^0 (dB)
 TEST SITE # 1, HIBBERT

DATE: 2/25/80

FREQUENCY (GHZ)	1.6	2.5	4.4	8.6	13.0	17.0	35.6
ANGLE=50 DEGREES	RANGE= 18.57 (m)			TIME=1607			
HH				-11.91	-9.50	-8.28	-9.22
HV				-13.41	-16.04	-14.76	
VV				-8.58	-9.49	-6.56	-9.97